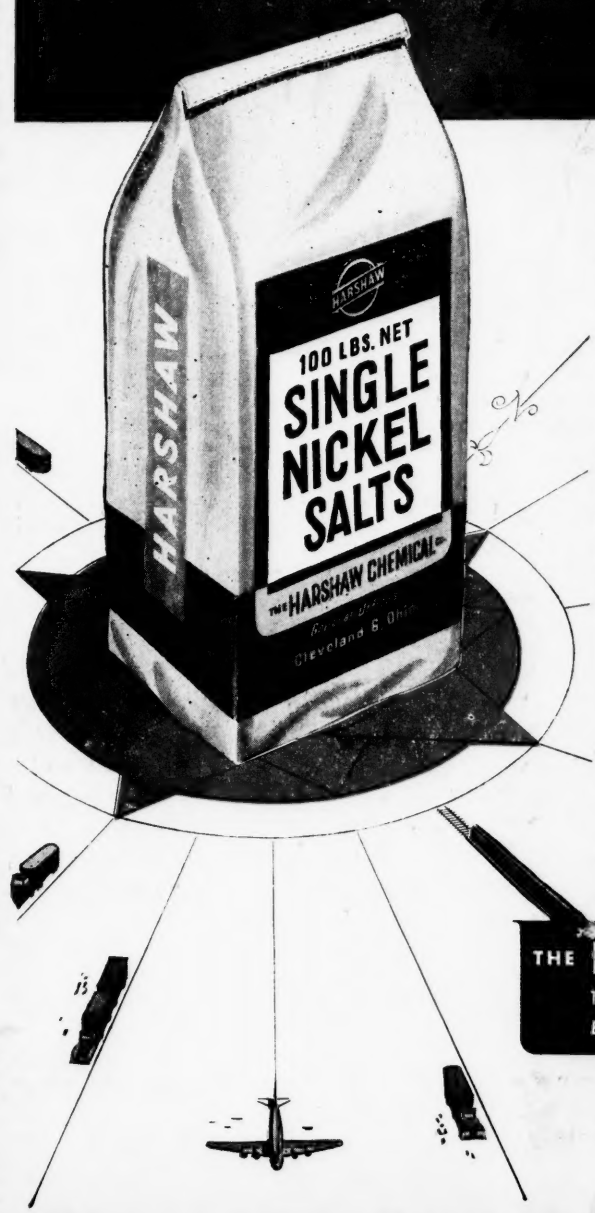
Metals Review

THE NEWS DIGEST MAGAZINE

VOLUME XXI—No. 6 | This Month: Cleaning and Finishing | JUNE, 1948



Additional production facilities have made it possible for us to carry ample stocks of single nickel salts at all our branches.

To save time and to speed up delivery, send your order to the nearest shipping point:

Cleveland 6, Ohio. . . . 1945 East 97th St.
Chicago 11, Ill. . . . 445 Lake Shore Drive
Cincinnati 2, Ohio . . . American Building
Detroit 27, Mich. . . . 9240 Hubbell Ave.
Houston 2, Texas . . Mellie Esperson Bldg.
Los Angeles 14, Calif. . . 609 S. Grand Ave.
New York 17, N. Y. . . 420 Lexington Ave.
Philadelphia 3, Pa. . . . 117 South 17th St.
Pittsburgh 3, Pa. . . Seventh & Carson Sts.

When you are ready to write your order, remember Harshaw Single Nickel Salts are far superior to the old large crystals, yet cost no more.

HARSHAW

THE HARSHAW CHEMICAL CO.
1945 East 97th Street, Cleveland 6, Ohio
BRANCHES IN PRINCIPAL CITIES

MELLON INSTITUTE
LIBRARY
JUN 29 1948
PITTSBURGH, PA.

AT LONG LAST! NOW READY

METALS HANDBOOK 1948 EDITION

TO A.S.M. MEMBERS: INSTRUCTIONS FOR EXCHANGE

CANADIAN AND FOREIGN MEMBERS: PLEASE SEE SPECIAL NOTICES BELOW

This is your official notice that the 1948 edition of the ASM METALS HANDBOOK is available and will be forwarded to all members in good standing upon receipt of the 1939 edition of the METALS HANDBOOK now in your possession.

The Board of Trustees requires that the old edition must be returned before the new one may be sent. The purpose of returning the old books is to take them out of circulation so that members will have only the very latest information.

Just wrap one layer of paper around the old book and tie it securely with a stout cord. The book weighs approximately five pounds, and the parcel post rate (depending on your distance from Cleveland) is as follows:

Established rates for mailing the old Handbook, 1939 edition, to Cleveland

Local	Zone 1-2 up to 150 Miles	Zone 3 150-300 Miles	Zone 4 300-600 Miles	Zone 5 600-1000 Miles	Zone 6 1000-1400 Miles	Zone 7 1400-1800 Miles	Zone 8 Over 1800 Miles
10c	**14c**	**18c**	**25c**	**34c**	**41c**	**52c**	**61c**

NOTE: When a member resides 600 miles or over from Cleveland the book may be shipped by express prepaid at less cost than by parcel post.

CANADIAN MEMBERS

Please *do not* mail your '39 Handbook to Cleveland, but mail or deliver it to your local chapter secretary. He will handle details of exchange.

PLEASE DO NOT SHIP TO CLEVELAND.

FOREIGN MEMBERS

You will *not* be required to return your old edition. The '48 edition will be mailed to you automatically.

ALLOW AT LEAST THREE WEEKS FOR EXCHANGE

Please consider the time required for the book to travel to the Cleveland office, where the records will be processed, new labels made and forwarded to the printers, so they can ship the new book to you.

Every effort will be made to reduce the time interval to the minimum but three weeks may elapse from the time you mail your copy until your new edition is received.

The Society can accept for exchange only that old Handbook which has the member's name and number on the inside front cover which corresponds with the records in the national office; also the member's dues must be paid in full at the time the book is received in the national office. A new book cannot be sent to the member who has been billed for dues but whose dues have not yet been received at headquarters.

MAIL THE OLD HANDBOOK AT ONCE TO

AMERICAN SOCIETY FOR METALS

7301 EUCLID AVE. CLEVELAND 3, OHIO

Metals Review

THE NEWS DIGEST MAGAZINE

RAY T. BAYLESS, Publishing Director — MARJORIE R. HYSLOP, Editor — GEORGE H. LOUGHNER, Production Manager

VOLUME XXI, NO. 6 — **JUNE, 1948**

A.S.M. REVIEW OF METAL LITERATURE

ORE BENEFICIATON 4
Preparation and Concentration

SMELTING, REDUCTION AND REFINING 4
(Including Electrolytic Refining)

PROPERTIES 10
Physical, Mechanical and Chemical

CONSTITUTION AND STRUCTURE 12
Metallography, Constitution Diagrams, Crystal Structure

POWDER METALLURGY 16
Processes and Products

CORROSION 18
Theory, Measurement, Prevention (Except Coatings)

CLEANING AND FINISHING 22
Chemical and Mechanical; All Types of Coatings Except Electrodeposited

ELECTRODEPOSITION AND ELECTROFINISHING 24
(Plating, Electropolishing, Electroforming)

PHYSICAL AND MECHANICAL TESTING 26
(Except Quality Control and Stress Analysis)

ANALYSIS 28
Qualitative and Quantitative; Identification Methods

APPARATUS, INSTRUMENTS AND METHODS 30
Industrial Measurement and Control (Except Temperature); Laboratory Equipment and Procedures

INSPECTION AND STANDARDIZATION 34
(Including Quality Control, Radiography, Specifications)

TEMPERATURE MEASUREMENT AND CONTROL 36

FOUNDRY PRACTICE 36
Methods and Equipment (Except Furnaces)

SCRAP AND BYPRODUCT UTILIZATION 42

FURNACES AND HEATING DEVICES 42
(Including Induction and Resistance Heating Equipment)

REFRACTORIES AND FURNACE MATERIALS 44

HEAT TREATMENT 46
(Including Flame Hardening, Induction Heating, Cold Treatment)

WORKING 48
Rolling, Drawing, Forging, Stamping and Presswork, Shot-Peening

MACHINING 50
(Including Tools, Machinability and Cutting Fluids; Excluding Flame Cutting)

MISCELLANEOUS FABRICATION 54
General Manufacturing and Assembly Procedures; Plant Operations; Materials Handling

JOINING AND FLAME CUTTING 54
Welding, Brazing and Soldering

APPLICATIONS 56
General and Specific Uses of Metals

DESIGN AND STRESS ANALYSIS 58
Metallurgical Factors in Design of Parts, Equipment and Structures

STATISTICS 60
Resources, Supplies, Production

MISCELLANEOUS 60
(Including Research, Lubrication and Friction; Other General and Unclassified Subjects)

NEW BOOKS 62

METAL FINISHING SECTION

Cleaning and Finishing, by Arch B. Tripler, Jr. 3

A year's developments in cleaning, pickling, metal coatings, barrel finishing, polishing, buffing, grinding, anodizing and coloring, as reflected in current literature

Finishing Equipment 9

A year's new products designed for metal cleaning, polishing, protective coating and electroplating, as described by the manufacturers

LECTURES REPORTED

Control of Blast, Uniformity of Operation Essential in Shot-Peening—John C. Straub 29

Metallurgical Aspects of Electroplating—Leland Morse 31

Grinding Symposium Features Wheel Selection, Fluids, Crush Dressing, Centerless Grinding 33

Symposium on Nondestructive Testing ... Hardening Theories ... Age Hardenability ... Gradiation Heating ... Other Lectures, News and Personal Items 23-59

DEPARTMENTS

Reader Service Coupon 21
The Reviewing Stand 23
Compliments 31
A Bibliography of Metallurgical Books, Part IV, by Sibyl E. Warren 41
Employment Bureau 63
Advertising Index 64

Published monthly by the American Society for Metals, 7301 Euclid Ave., Cleveland 3, Ohio; Francis B. Foley, President; Harold K. Work, Vice-President; William H. Eisenman, Secretary; E. L. Spanagel, Treasurer; Arthur E. Focke, John E. Dorn, E. G. Mahin, C. M. Carmichael, Trustees; Alfred L. Boegehold, Past President. Subscriptions $5.00 per year ($6.00 foreign). Single copies $1.00. Entered as Second Class Matter, July 26, 1930, at the Post Office at Cleveland, Ohio, under the Act of March 3, 1879.

Now is the time to order your Big, NEW 720 page volume

REVIEW OF METAL LITERATURE

Be sure to get the latest edition of the ASM Review of Metal Literature. It is on the press right now—will be ready very soon. Price of this important 1947 edition will be $10.00 to ASM Members, $15.00 to all others.

Published annually since 1944, yearly editions of the ASM Review of Metal Literature are your reference key to all published information from all sources on metals and the metal industry. New 1947 edition with its 8300 abstracts, contains a complete survey of all of the metallurgical literature published during the period, January through December, 1947. The four editions give you a complete four-year record of the industry. Future editions will report literature of succeeding years.

The brief digests of this literature are not intended to serve as a substitute for a reading of the articles listed. They are, rather, brief abstracts designed to indicate the scope and content of the article so that you may determine whether it is something you want to read in its entirety.

The table of contents lists the 27 sub-divisions and classifications of the industry with explanatory notes on each. This classification is arranged primarily by process. There is also a comprehensive subject index giving hundreds of references to metals, processes and equipment. These are indexed in detail with subheads and cross-references to enable the location of articles on any specific subject related to the metal industry.

In using this book, such broad fields as corrosion, foundry practice, or welding may be quickly located in the table of contents. Details on such metals as aluminum alloys, copper, or cast iron may be located in the subject index. Specific aspects of corrosion or welding may be checked in the subject index. An author index is also provided and a list of addresses of the 376 publications that have been reviewed during the year.

Every effort has been made to make this a complete annual review of metal literature so that in consulting it the reader can be assured that he is being referred to *all* of the material published during the year on the specific subject he is studying. All digests were prepared in the library of Battelle Memorial Institute, Columbus, Ohio.

8300 Abstracts of Metallurgical Literature Published During 1947

720 Pages . . . 6 x 9 red cloth binding . . . price $15.00 ($10.00 to ASM Members)

USE THIS COUPON TO ORDER—NOW

AMERICAN SOCIETY FOR METALS

7301 Euclid Avenue, Cleveland 3, Ohio

- - - - - - - - - - - - - - - - CLIP AND MAIL - - - - - - - - - - - - - - - -

AMERICAN SOCIETY FOR METALS
7301 Euclid Avenue Cleveland 3, Ohio

As soon as it is off the press, send me the new 1947 volume of the ASM Review of Metal Literature.

☐ I am an A.S.M. Member; price $10.00

☐ I am not an A.S.M. Member; price $15.00

NAME ..... CHAPTER AFFILIATION .....

FIRM .....

ADDRESS .....

CITY ..... ZONE ..... STATE .....

BILL ME LATER ..... BILL MY FIRM ..... CHECK ENCLOSED .....

METALS REVIEW (2)

MELLON INSTITUTE
LIBRARY
JUN 29 1948
PITTSBURGH, PA

Cleaning and Finishing

A Year's Developments in Cleaning, Pickling, Metal Coatings, Barrel Finishing, Polishing, Buffing, Grinding, Anodizing and Coloring, as Reflected in the Current Literature

By Arch B. Tripler, Jr.

WITH COMPETITION restored and wages on the increase, an unmistakable trend to cut costs in the cleaning and finishing industry has been apparent during the past year. This is reflected in the widespread use of semi-automatic and full-automatic equipment and in the tendency toward increased efficiency of operation. It is gratifying to observe also that some attention is being given to fundamental studies; the results may not find immediate application, but are sure to pay off in the long run.

Cleaning

Much newly designed equipment embodies spray cleaning—a process that affords several advantages over simple dipping. The mechanical force of the spray combined with the chemical action of the cleaner does a rapid and efficient job. Deeply recessed and complicated parts are relatively easy to clean. Spray cleaning lends itself well to automatic operation and can be used with aqueous or organic cleaners (7-373, Nov. 1947)*.

Dip or spray cleaning may not be sufficiently drastic for the more recalcitrant soils, and for this purpose electrolytic cleaning is increasing in use (7b-10, Feb. 1948). Cathodic cleaning has the advantage of higher rate of gas evolution. Anodic cleaning eliminates the possibility of hydrogen embrittlement and also the deposition of metallic impurities from the cleaner.

The trial-and-error method is not without merit and is probably the most widely used means of solving cleaning problems. Consideration of the fundamental aspects of metal cleaning, however, will possibly reduce the number of trials required to solve a specific problem. Cleaning can be thought of as the neutralization of the attractive forces existing between the metal surfaces and the soils (7a-9, Feb. 1947). These forces arise, for the most part, from mechanical attraction, chemisorption and electrophoretic charge, which may operate individually or in combination. The nature of the force is in turn dependent on, first, the characteristics of the metal surface and, second, the nature of the soil. Metal surfaces are characterized by their chemical reactivity and their physical qualities. Soils are classified as inert, hydrophilic, or hydrophobic. Analysis of a problem on the basis of these factors can serve as a guide to the correct cleaning method.

The evaluation of cleaners is a matter of continuing interest. The water break test and its modifications, the weight-of-residue soil method, the fluorescent method, and the wiping test have all been used with varying degrees of success. To this list has been added another, the residue pattern test (7-512, Jan. 1948). A test panel is subjected to a standard routine of soiling, cleaning, and rinsing. The panel is then dried at 50° C. for 20 min. and examined visually. Where the cleaning has not been thorough, the test panel will contain areas with a residue pattern. The area can easily be estimated to within several per cent for comparison purposes.

Deep drawn steel sheet parts always have a residual film of die lubricant on their surfaces. This film must be removed prior to subsequent processing. At one plant (7-346, Oct. 1947) it had been customary to do this by spray cleaning using an alkaline cleaner. Newly drawn parts were easily cleaned but parts which had been stored before cleaning could not be freed of the lubricant. A laboratory investigation disclosed that a combination of moisture in the drawing compound and the storage time was responsible.

Speculation as to the part water played in thus "aging" the material suggested three possibilities:

1. Water may react with the iron to form compounds which in turn react with fatty acids in the drawing compound.

2. Water may permit direct reaction of the drawing compound with the iron.

3. Water may establish conditions whereby polar compounds can be adsorbed on the metal surface.

It is known that certain metallic soaps are insoluble in water and alkaline cleaning solutions but dissolve readily in organic solvents. In view of the fact that properly "aged" drawing compounds were removed from steel by first treating them with organic solvents and then with an alkaline cleaner, it would appear that condition No. 1, above, is most nearly correct.

No universal cleaner has yet been discovered, but the so-called multiple-phase cleaner is a step in that direction (7-174, June 1947). This cleaner is composed of organic and inorganic solvents mixed with water in two separate layers. The upper layer is an unemulsified solvent and the lower is a dispersion or emulsion of organic solvents in water. This cleaner can be most efficaciously used in the form of a spray, in which mechanical mixing of the two phases occurs. Even though mixed, the phases maintain their separate characters. However, the two phases together will perform cleaning operations that neither alone can do, such as the removal of fresh fingerprints.

In many localities, hard waters are the source of minor difficulties in cleaning and finishing. Such waters can be conditioned by passing them through a single, easily regenerated ion exchange bed to obtain soft water, or through two such beds to obtain a product comparable to distilled water (7-113, May 1947). Among the reported advantages of conditioned water are improved adhesion of coatings, reduction of drag-in, elimination of sludge in hot alkaline solutions, and more easily buffed electro deposits. The storage and handling of pure water presents a minor problem because of its corrosiveness.

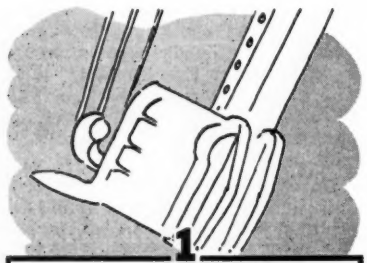
The emulsifiable cleaners, while not new, are of fairly recent origin and deserve a short description. They combine the action of a solvent and the emulsifying properties of a solvent-soluble dispersing agent, or a soap, in the presence of a blending agent. The solvent may be kerosene or naphtha; the emulsifying agent, a soap such as potassium oleate; and the blending agent, an organic compound such as butyl cellosolve, cresylic acid, a cyclohexanol derivative, or a synthetic surface-active agent (7-441, Dec. 1947). Current cleaning and pickling practices are also reviewed in some detail in this article.

(*Turn to page* 5)

*Literature references are cited by the corresponding item number in the *Review of Current Metal Literature* instead of repeating entire title, author, and source; this information can be obtained by referring to *Metals Review* for the month indicated.

A. S. M. Review of Current Metal Literature

An Annotated Survey of Engineering, Scientific and Industrial Journals and Books Here and Abroad, Received in the Library of Battelle Memorial Institute, Columbus, Ohio, During the Past Month



ORE BENEFICIATION

1a—General

1a-14. Attachment of Mineral Particles to Air Bubbles in Flotation. H. Rush Spedden and William S. Hannan, Jr. *Mining Technology*, v. 12, March 1948, T.P. 2354, 6 pages.

One part of the flotation process which has not been adequately explained is the mechanism by which selected mineral particles become attached to air bubbles. Present theories and results of a study by means of high-speed, motion picture photography of the formation of the air-mineral interface.

1a-15. Review of Results Obtained From Semiportable HMS Plants. Robert W. Hernlund. *Mining World*, v. 10, April 1948, p. 23-27.

Details of results obtained from 10 installations of heavy-media-separation units ranging from minerals of high specific gravity, such as galena, to anthracite coal. Cost data.

1a-16. Mexico's Ore-Testing Laboratory. T. L. Johnston. *Engineering and Mining Journal*, v. 149, April 1948, p. 95.

1b—Ferrous

1b-9. Completes New Laboratory for Study of Taconite Concentration. *Steel*, v. 122, May 10, 1948, p. 108, 110, 112.

New laboratory of Oliver Iron Mining Co., Duluth, Minn.

1c—Nonferrous

1c-33. The Presence in Nature of Certain Stable Products of the Spontaneous Disintegration of Uranium. (In Russian.) V. G. Khlopin, E. K. Gerling, and N. V. Baranovskaya. *Izvestiya Akademii Nauk SSSR, Otdelenie Khimicheskikh Nauk* (Bulletin of the Academy of Sciences of the U.S.S.R., Section of Chemical Sciences), Nov.-Dec. 1947, p. 599-604.

A formula based on the uranium and the xenon content of uranium ores is proposed for determination of the absolute age of the mineral. It is assumed that all isotopes of U undergo spontaneous disintegration. A specially designed apparatus and the method of its use for determination of the xenon content. 12 ref.

1c-34. Wet Grinding of Ferrosilicon for Heavy Media. E. H. Crabtree and T. C. King. *Mining Technology*, v. 12, March 1948, T.P. 2350, 6 pages.

The ferrosilicon grinding unit at the Central Mill of Eagle Picher Mining & Smelting Co. has demonstrated ability to supply a product of suitable size by wet grinding at a cost of 33% less than the corresponding purchased dry-ground ferrosilicon. Wet classification of ferrosilicon in closed circuit operation has been solved with a novel hydraulic classifier.

1c-35. Exploration, Development, Mining, and Milling of a Unique Tungsten Ore Body at the Yellow Pine Mine, Stibnite, Idaho. John W. Cole and H. D. Bailey. *Bureau of Mines, Information Circular* No. 7443, April 1948, 24 pages.

The ore body dealt with contains gold-bearing iron sulphides, stibnite, and scheelite. These minerals are distributed quite irregularly. Includes description of development of a satisfactory concentration flow sheet, including crushing, grinding, and flotation; and circuits for iron sulphide (from which gold is obtained), for antimony sulphide, and for high and low-grade tungsten. Cost analysis.

1c-36. How Oxidized Lead Ore is Floated at St. Anthony. E. V. Given. *Engineering and Mining Journal*, v. 149, April 1948, p. 88-90.

Refers to methods used at St. Anthony Mining & Development Co., Ltd., Tiger, Ariz. Oxide and sulphide ores are hoisted in the same shaft and crushed by the same equipment, but there they part company. Flow sheet for oxide ores.

1c-37. Search for Elements 94 and 93 in Nature. Presence of 94^{239} in Pitchblende. Glenn T. Seaborg and Morris L. Perlman. *Journal of the American Chemical Society*, v. 70, April 1948, p. 1571-1573.

A chemical method for separating and concentrating elements 94 and 93 from uranium and thorium, and results of its application to a sample of pitchblende concentrate from the Great Bear Lakes region of Canada.

For additional annotations indexed in other sections, see: 27a-78.

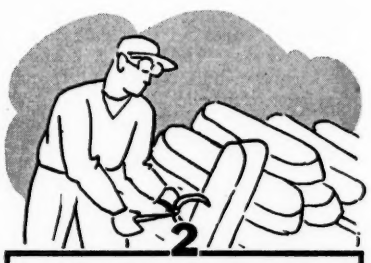
A clearly written and exhaustive explanation of the functions of all the alloying elements used in steel, both alone and in combination.

THE ALLOYING ELEMENTS IN STEEL

by Edgar C. Bain

312 pages—$4.00

American Society for Metals
7301 Euclid Ave. Cleveland 3, Ohio



SMELTING, REDUCTION and REFINING

2a—General

2a-7. Basic Openhearth Slag Control. Part VII. Properties of Good Slags and Their Development. Charles R. Funk. *Blast Furnace and Steel Plant*, v. 36, May 1948, p. 539-549.

Data sheets showing characteristics of various type slags. Macrographs and micrographs of pancake test; and data on physical, chemical, and petrographic properties.

2b—Ferrous

2b-72. Slag Control and Determination of Optimum Slag Composition in Basic Openhearth Practice. A. J. Kesterton. *Iron and Steel Institute, Special Report No.* 39, "Reports of the Affiliated Local Societies", Dec. 1947, p. 38-49.

Determination of optimum tapping-slag composition as a target for the operation of a slag-control technique in relation to the manufacture of rimming steel. The dissolved-oxygen requirement at tapping for good rimming action, and the relationship between dissolved oxygen and slag composition. At a given carbon concentration, the rimming action is controlled by the dissolved oxygen, which in turn is controlled by the slag FeO, provided that basicity is constant. How the effect of slag composition on removal of sulphur and phosphorus to below the specification limits can be calculated. Current methods for control of tapping-slag compositions. 12 ref. (Presented at meeting of Cleveland Institution of Engineers, Middlesbrough, England, Feb. 11, 1946.)

2b-73. Boiling of Liquid Metal in the Bath of a Steel-Melting Furnace. (In Russian.) V. S. Kocho. *Zhurnal Tekhnicheskoi Fiziki* (Journal of Technical Physics), v. 17, Dec. 1947, p. 1527-1530.

The intensity of the process of liquid-metal and slag boiling in the bath of the steel furnace. Dependence between optimum rate of carbon burn-out and intensity of the boiling process was established. 13 ref.

(Turn to page 6)

Pickling

With increased activity on the part of municipalities in preventing river and harbor pollution, the disposal of waste pickle liquors is receiving considerable attention.

The scarcity of high-calcium lime for use as an acid neutralizer initiated a search for a substitute (7-57, March 1947). Readily available dolomitic limes were found to be adequate. While they have lower reaction rates with acids than do high-calcium limes, the basicity advantage of dolomitic limes places the two agents on a relatively equivalent basis. Where considerable volumes of liquor are involved, several expedients can be adopted to increase the reaction rates and yet not exceed the cost of the high-calcium limes. A unique system of upflow limestone beds has been devised (7-280, Sept. 1947), eliminating expensive acid pumps.

The controlling reactions in the pickling of steel appear to be electrochemical in nature and to involve Fe and Fe_3O_4. The scale formed on low-carbon steel above 1065° F. consists of three oxide layers. Going from the outer surface toward the basis metal, these are Fe_2O_3, Fe_3O_4 and FeO. Under equilibrium conditions at 1085° F., the FeO phase decomposes to a eutectoid mixture of Fe and Fe_3O_4. This decomposition reaches a maximum rate at 895° F. Experimental results show that transformation at 895° F. provides conditions favoring the most rapid pickling rates (7-435, Dec. 1947).

Based on this result, recommendations for the oxide conditioning of strip steel have been formulated. Strip hot finished at 1500° F. should be quenched on the runout table at 700 to 750° F. before entering the coiler. This temperature range is specified for 2 to 4-ton coils whose heat-back upon coiling will elevate the temperature to 900 to 950° F. Following an air cool to 700° F., the coils should be water quenched and are then ready for pickling. In contrast to this finding, it may be recalled that 25 years ago, Pilling and Bedworth found that, if steel is annealed for 1 hr. at 930 to 1020° F., pickling becomes difficult (*Journal of the Institute of Metals*, v. 29, 1923, p. 529).

Pickling inhibitors are receiving renewed study, and more fundamental criteria are being set up for their evaluation. A good inhibitor not only reduces the attack on the metal, with consequent reduction in hydrogen evolution, but also lessens the quantity of hydrogen entering into the iron because of its influence on the recombination of atomic to molecular hydrogen (7-76, April 1947).

In an investigation on hydrogen embrittlement (7-319, Sept. 1947), the effects of steel composition, heat treatment, and cold working on the hydrogen embrittlement of stainless steel wire during cathodic pickling were studied. Cold worked Type 440-C (17% Cr, 1.0% C) breaks in the as-drawn condition at a bend angle of 65° and is so extremely sensitive to hydrogen embrittlement that charging with hydrogen for only 15 sec. will reduce the bend value 50%. When annealed, however, it will bend 180° after absorbing hydrogen for several minutes.

Types 410 (12% Cr) and 431 (16% Cr, 2% Ni) are extremely susceptible to hydrogen embrittlement in the hardened condition, but are virtually immune when annealed. Cold working increases the susceptibility of hardened 410 making it the equivalent of hardened 440-C, but in neither grade does cold working change the immunity of the annealed wire.

A second paper (7-320, Sept. 1947) gives the results of an investigation on acid composition, concentration, temperature, and pickling time as factors in the hydrogen embrittlement of mild and stainless steel wire. Strongly ionized acids such as sulphuric, hydrochloric, and hydrofluoric are alike in the degree of embrittlement. A minimum concentration, which lies above 0.01*N*, is required to cause embrittlement. Stainless steels regain nonsusceptibility in sulphuric acid solution when the concentration reaches 10*N*. The less ionized acids such as phosphoric and acetic cause as severe embrittlement as the stronger acids, but the concentration range in which embrittlement occurs is contracted in rough proportion to their respective degrees of dissociation. Nitric acid solution or nitric-hydrofluoric acid mixtures did not cause embrittlement in stainless steels, and nitric acid solution caused only slight embrittlement in S.A.E. 1020. Increasing the temperature caused a uniform increase in embrittlement.

Submerged combustion for heating pickling tanks is reported to be more efficient and less costly than the usual methods of heating (7-121, May 1947). With this type of installation, the gas and air mixture is forced into a burner which is beneath the surface of the solution. When the burner has been purged of liquid, the gas mixture is automatically ignited. The combustion products are vented through holes in the burner near the bottom of the tank, providing both heat and agitation. It is claimed, for this application, that there is no dilution such as occurs with steam exhaust heating. However, any dilution due to steam exhaust is usually balanced by evaporation and dragout, so this is not a fair claim.

Large-scale oxide removal from permanent steel structures is not amenable to acid pickling because of obvious difficulties. Flame priming appears to be a suitable method for descaling and was used successfully to prepare corroded hydro-electric dam gates for subsequent painting (7-271, Aug. 1947). The corroded surface was subjected to an intense, high-velocity flame which drove out all moisture and caused the loose scale to expand and pop off. The flame treated area was immediately gone over with a wire brush and then swept with a wire broom. Paint was applied while the surface was still warm. This low-temperature bake provided good bonding and a lasting protection.

Metal Spraying

While processes for metal spraying have been known for three decades, their use has only recently become widespread. The Schori method, utilizing a metal powder, seems to be the most prevalent in Europe, while the wire-type gun is favored in this country. The surface preparation previous to metal spraying is of utmost importance. It is customary to sand or steel-grit blast or rough thread the surface. An additional method, in which an iron electrode is rubbed across the surface in a manner similar to arc welding, has been developed (7a-12, Feb. 1948). Small particles of the electrode are fused into the surface, producing a roughened crater-like effect. In this way a large number of irregularities are produced to which the metal coating can adhere. Such pretreatments as the above are advantageous in that they do not involve hydrogen embrittlement.

Sprayed metal is approximately 10% less dense than electrodeposited or cast metal. During the spraying process, a small amount of oxidation takes place but has not been found harmful (7-445, Dec. 1947).

Metal spraying adapts itself admirably to the building up of worn machine parts (7-172, June 1947; 7-274, Aug. 1947). Particularly in repairing heavy machinery parts, spraying may be advantageous because it is often unnecessary to dismantle the machinery.

Metal Coatings—Electroless

A wartime search for a rapid method that would produce a uniform, continuous, and easily applied metallic layer on steel parts, without disturbing the fine dimensional tolerances, led to the use of fused metallic salts (7-486, Jan. 1948). One successful bath consisted of stannous chloride, either pure or diluted with small amounts of ammonium chloride. Since the deposition of tin involves a displacement reaction, the iron content of the bath builds up over a period of time. The bath will tolerate up to 5% iron and, since the iron can be removed by electrolysis, this presents no difficulty.

Metals can be deposited on other metals higher in the electromotive force series without the aid of an

(*Turn to page 7*)

2b-74. Contribution a l'Etude de la Cementation de la Fonte par Quelques Métalloides et Métaux. La Cémentation "Dispersée". (Study of Cementation of Cast Iron Using Certain Metalloids and Metals. "Dispersed" Cementation.) Louis-Fernand Girardet and Andre Guedras. *Fonderie,* Dec. 1947, p. 970-973; discussion, p. 973-974.

Cementation using ferrous alloys and PbS, and also "dispersed" cementation using PbO, ZnS, ZnO, SnS, SnO_2, and Sb_2S_3.

2b-75. Openhearth Furnace Models. A. R. Philip. *Nature,* v. 161, March 27, 1948, p. 479.

Recent large-scale experiments on openhearth furnaces emphasize the need for more fundamental knowledge of the flow of fuel, air, and combustion products through the furnace chamber. Plastic models of openhearth furnaces with differing port designs were made on a 1/24 linear scale. Both fuel gas and air flow through the model were studied using a variety of methods. At present fine aluminum particles suspended in water, and illuminated by intense light, are used. By suitably compounding the 2-dimensional patterns thus obtained, a 3-dimensional flow pattern is formed.

2b-76. Enriched Blast; German Use of Oxygen in Blast Furnaces and Converters. *Iron and Steel,* v. 21, April 1948, p. 129-132. Condensed from F.I.A.T. Report No. 1203.

In one blast-furnace plant, one low-shaft blast-furnace plant, and one converter plant. Achievements and data as well as novel ideas.

2b-77. Oxygen Enrichment of the Cupola Blast. A. K. Higgins. *Iron Age,* v. 161, April 22, 1948, p. 72-77.

The possibility of increasing melting temperatures, reducing initial melting time, and boosting melting rates by use of oxygen. Cupola runs with and without enrichment and the effect of oxygen additions on temperatures, lining life, metal analysis, and results obtained with intermittent enrichment.

2b-78. Source of Sulphur Entering Steel Disclosed by Radioactive Tracers. *Steel,* v. 122, April 26, 1948, p. 112.

Outlines results of largest tracer experiment ever conducted, and probably the first using full-scale industrial equipment. The experiment was conducted in Republic Steel's Cleveland plant by Arthur D. Little, Inc. The proportion of the coke's sulphur which had come from the pyrites was found to be about the same as in the original coal, indicating that both forms are carried over to the coke equally, and that there is no advantage in buying coal with a low pyritic-sulphur content. Potentialities for other metallurgical problems.

2b-79. Improvement of Machinability in High Phosphorus Gray Cast Iron. William W. Austin, Jr. *American Foundrymen's Association, Preprint* No. 48-21, 1948, 14 pages.

Following review of the literature, an attempt to find commercially feasible means of overcoming the harmful effects of phosphorus upon machinability was made. The three fundamental methods of approach followed were: Modification of the mode of occurrence of the phosphide constituent in the microstructure; control of the microstructure exclusive of the phosphide constituent; and removal of constituents known to have adverse effects on machinability. Significant improvement may be attained by a combined treatment involving sodium carbonate desulphurization and Zr-alloy addition. 30 ref.

2b-80. Sira v Koksu. (Sulphur in Coke.) Jindrich Sarek. *Hutnické Listy* (Metallurgical Topics), v. 3, Jan. 1948, p. 9-11.

Consideration of the literature concerning small blast furnaces fired with charcoal led to the conclusion that present furnaces could be run acid with smaller coke sulphur content, at least in some cases. This would result in a decrease of fuel and limestone consumption and in lowering of production costs. The savings in coke and limestone.

2b-81. Direct Oxidation. Edward B. Hughes. *Proceedings National Open Hearth Committee, Iron and Steel Division, American Institute of Mining and Metallurgical Engineers,* v. 30, 1947, p. 14-32; discussion, p. 32.

The term "direct oxidation" refers to use of elemental oxygen introduced directly into the openhearth bath. Describes what is being done at present with a supply of 1,000,000 cu. ft. per mo. at $3.35 per cu. ft. ($80.40 a ton) at Wheeling Steel Corp. Data from typical heats.

2b-82. Application of the Shaker Device to Medium Carbon Rimmed Steels. Mark Geigel. *Proceedings, National Open Hearth Committee, Iron and Steel Division, American Institute of Mining and Metallurgical Engineers,* v. 30, 1947, p. 33-42.

Theory and practice of the production of rimmed-steel ingots of good quality. Various devices are used to secure satisfactory elimination of gases from the molten metal, thus decreasing porosity and other inhomogeneities. Shaking device and its operation. Comparative results from "shaker" and regular ingots are shown by macrographs and by distribution of C, Mn, S, and P at various locations within the ingots. The shaking process was shown to be of value in production of rimmed steel of improved structure and physical properties, and carbon contents.

2b-83. Quality of Hot Metal. L. A. Lambing. *Proceedings, National Open Hearth Committee, Iron and Steel Division, American Institute of Mining and Metallurgical Engineers,* v. 30, 1947, p. 62-65; discussion, p. 65-67.

Types of metallic charge and recommended alloy contents. Results of questionnaire on hot-metal quality and use of duplex processes.

2b-84. Use of Oxygen in Openhearth Furnaces. J. J. Golden. *Proceedings, National Open Hearth Committee, Iron and Steel Division, American Institute of Mining and Metallurgical Engineers,* v. 30, 1947, p. 68-73; discussion p. 73-74.

Results of a survey of the various types of burners used. The most important difference is the wide variation in the areas of the oxygen outlets. Some flame-radiation data and results of use of the oxygen lance for carbon removal. Possibility that the latter might be the more economical of the two methods.

2b-85. Use of Oxygen at East Works, American Rolling Mill Co. H. V. Flagg. *Proceedings, National Open Hearth Committee, Iron and Steel Division. American Institute of Mining and Metallurgical Engineers,* v. 30, 1947, p. 74-76; discussion, p. 76-82.

With experiences in use of oxygen at several plants, also.

2b-86. Pig-Iron Substitutes in Basic Practice. *Proceedings, National Open Hearth Committee, Iron and Steel Division. American Institute of Mining and Metallurgical Engineers,* v. 30, 1947, p. 114-123.

Brief papers or discussions by E. J. Nelson, R. R. Fayles, H. L. Tear, W. H. Steinheider, A. E. Getz, G. L. McMillen, R. L. Baldwin, and A. R. Altman giving experiences at various mills.

2b-87. Recarburization of Soft Melts. *Proceedings, National Open Hearth Committee, Iron and Steel Division, American Institute of Mining and Metallurgical Engineers,* v. 30, 1947, p. 123-127.

W. H. Carpenter discusses use of oil for recarburizing soft melts; A. E. Getz describes procedure of Keystone Steel and Wire Co; R. R. Fayles discusses use of graphite for reboiling soft-melt heats; and R. J. Zemaneck describes injection of carbon into the bath.

2b-88. Deoxidation Practice in Basic Steel Foundries. G. A. Lillieqvist. *Proceedings, National Open Hearth Committee, Iron and Steel Division, American Institute of Mining and Metallurgical Engineers,* v. 30, 1947, p. 128-135; discussion, p. 135-142.

Importance of proper deoxidation; pinhole porosity; effect of aluminum additions on inclusions and physical properties; method of adding aluminum; use of selenium additions; and effect of slag on deoxidation. Extended discussion under the headings: hydrogen in cast steel; fluidity of furnace filled vs. ladle-killed openhearth heats; and relation of fluidity to composition and temperature.

2b-89. Steel Quality and Steel Castings. C. B. Jenni. *Proceedings, National Open Hearth Committee, Iron and Steel Division, American Institute of Mining and Metallurgical Engineers,* v. 30, 1947, p. 143-145; discussion, p. 145.

Important factors in production of basic openhearth steel for use in cast-steel products.

2b-90. The Mechanism of the Carbon-Oxygen Reaction in Steelmaking. C. E. Sims. *Proceedings, National Open Hearth Committee, Iron and Steel Division, American Institute of Mining and Metallurgical Engineers,* v. 30, 1947, p. 146-159; discussion, p. 160, 164-168. Reprinted from *Electric Furnace Steel Proceedings,* 1946.

(Presented at Electric Furnace Steel Conference, Dec. 5, 1946.)

2b-91. Furnace Deoxidation in Basic Openhearth Practice. W. O. Philbrook. *Proceedings, National Open Hearth Committee, Iron and Steel Division, American Institute of Mining and Metallurgical Engineers,* v. 30, 1947, p. 168-171; discussion, p. 172-179.

Recent work and developments in the field of deoxidation practice. Analyzes the present state of our knowledge to see what deficiencies still exist. Discussion by R. H. Isenberg, J. F. Pollack, D. C. Hilty, B. M. Larsen, Charles Labeka, and C. F. Christopher. 10 ref.

2b-92. Temperature Considerations in the Solidification of Killed Steel Ingots J. W. Spretnak. *Proceedings, National Open Hearth Committee, Iron and Steel Division, American Institute of Mining and Metallurgical Engineers,* v. 30, 1947, p. 187-192; discussion. p. 193-194.

Experimental data and a theoretical analysis. Effect of superheat: the air gap; effect of mold-wall thickness on rate or heat abstraction; effect of initial mold-wall temperature on primary structure; time for completion of solidification; and heat balance in the freezing of ingots.

2b-93. Use of Water on Hot-Topped Steel at the Pouring Platform. G. W. Humes. *Proceedings, National Open Hearth Committee, Iron and Steel Division, American Institute of Mining and Metallurgical Engineers,* v.

(Turn to page 8)

externally applied current. As soon as the basis metal is covered, however, the action stops and only very thin deposits can be obtained in this way. It is possible, nevertheless, to deposit relatively thick coatings by a process called "electroless plating" (7-501, Jan. 1948).

Nickel and cobalt and alloys of the two metals are deposited from hot hypophosphite solutions on metallic surfaces that have catalytic properties. Iron, nickel, gold, cobalt, aluminum, and palladium have the required properties to serve as basis metals. The rate of deposition varies with conditions but is approximately 0.0005 in. per hr. Deposition on plastics has met with no success. No pretreatment has been discovered to make nonconducting surfaces catalytically active.

Production coating of glass surfaces by metal evaporation in a high vacuum is an outcome of wartime practice. Aluminized front-surface mirrors have been continuously processed at pressures below 10^{-5} mm. in a unit that has a series of locks, operated hydraulically, and controlled electrical interlocks and relays. A mirror 2 ft. square can be produced in 1 min. (7-467, Dec. 1947).

Molybdenum and tungsten have desirable corrosion and temperature resistant properties, but neither of these metals has been electrodeposited successfully in the pure state. A method for plating molybdenum and tungsten, their compounds and alloys, by pyrolysis of their carbonyl vapors has been developed (7-391, Nov. 1947).

Important products of this method are alloys with carbon and carbides of the metals. By adjusting the plating conditions, the carbon content of the coating may have any value from substantially zero to above 35 atom per cent. Coatings harder than sapphire have been produced. The specimen to be plated receives a preliminary cleaning, and a hydrogen reduction treatment at 500 to 800° C. The hydrogen pressure is then reduced to 0.05 mm. and the carbonyl introduced. Plating takes place for 10 min. at 800° C. and a carbon monoxide pressure of 0.01 mm. The temperature is then reduced to 525° C. and the partial pressures of both hydrogen and carbon monoxide are raised to approximately 0.12 mm. and plating continues. The rate of plating is of the order of 2.2 mils per hr.

Barrel Finishing

An ideal way of producing a variety of finishes on small parts is provided by barrel finishing. Grinding, deburring, polishing, buffing, honing and coloring are accomplished at an appreciable cost saving over other mechanical methods (7-173, June 1947). Certain variables are involved which have to be determined for each individual application. Speed of rotation, number of parts per load, type of object being finished, and the type of abrasive or polishing agent are the essential factors.

Arch Tripler, Jr., is on the electrochemical engineering research staff of Battelle Institute. He was formerly affiliated with the Crown Cork and Seal Co. and with Rustless Iron and Steel Corp. He is a graduate of Wagner College and studied at Johns Hopkins University.

While selection of the correct finishing agent is a controversial subject, certain materials appear to be accepted as standard. Granite chips for grinding, limestone chips for honing, and wet steel balls for coloring are examples. Numerous finishes can be produced with Alundum. Dry maple sawdust, which contains small hard fibers absent in other woods, (7-498, Jan. 1948), is frequently used as a polishing agent. Removable liners facilitate loading and unloading (7-485, Jan. 1948).

Polishing, Buffing and Grinding

Developments in mechanical grinding, polishing, and buffing have been mostly improvements in equipment. Many of the operations formerly done by hand are now done automatically by ingenious machines. Abrasive belts are finding wider acceptance for both automatic and manual installations (7-108, May 1947). They provide a larger surface area than do wheels and therefore require less frequent changes.

Water-soluble abrasives are being developed which promise to ease some of the cleaning problems (7-144, May 1947).

Lapping will produce very fine surface finishes while maintaining extremely close tolerances. An investigation of the lapping process with a specially designed machine (7-81, April 1947) showed that tolerances of from 4 to 80 micro-inches are possible, depending on conditions.

A new machine simultaneously grinds or polishes both sides of strip metal (7-325, Sept. 1947). Two models are procurable, one for strips up to 24 in. and the second for strips up to 42 in. Tandem operation makes continuous processing possible, and an oscillatory motion breaks up grit line directions.

The development of electropolishing during the late thirties was characterized by a wholesale rush to climb aboard this new bandwagon. The resulting patent litigations—together with the onset of war—delayed the commercialization of electropolishing. With the war behind us and the patent situation clarified, many opportunities are provided for the use of this relatively new process (7-186, June 1947). The shortage of skilled labor in the polishing and buffing trade will be reflected in the increased use of anodic polishing. Although stainless steel has received much attention, the process has been extended to carbon and other alloy steels, copper, brass, monel, nickel silver, aluminum, silver and magnesium.

Electropolishing does not provide the cutting and burnishing action of the mechanical polishing methods and therefore does not produce the same finish. For this reason, finishes produced electrolytically should not be evaluated in comparison with finishes produced on a wheel. They are different, but nowise less attractive.

Producing attractive surfaces for eye appeal does not exhaust the possibilities for the process. Among the additional commercial applications are "machining", reducing dimensions to exact size, removing burrs from stamped or punched edges, and buffing before a final electroplated finish.

The decision to use electrolytic polishing or conventional methods will have to be based on relative cost data and the standard of finish acceptable.

Anodizing and Coloring

Anodizing and coloring of aluminum are now common practices. In one of the most interesting applications the porous film contains light sensitive materials and is used for photography (7-67, April 1947). Preparation of the film, exposure and development follow conventional practices. Photos on aluminum have several advantages over those on paper. They are fireproof, are not destroyed by organic solvents, and are not affected by exposure to the atmosphere. Color photos on aluminum can be made by the familiar three-color process.

Magnesium alloys are now anodized by a process which forms a magnesium oxide and silicate film on the surface (7-192, June 1947). This film is formed electrolytically from a solution containing sodium hydroxide, water glass and a small amount of phenol. The film forms a receptive surface suitable for subsequent organic finishing or dye coloring.

Many of us remember the cast-iron kitchen range and how, at least once a week, it was brought to a high luster by the application of stove polish. In spite of the fact that the coal range is a disappearing species, the use of stove polish continues. In its most modern application, it protects iron and steel aircraft engine parts from corrosion (7-131, May 1947).

30, 1947, p. 194-196; discussion, p. 196.

Method followed resulted in reduction of holding time on the platform from 2 hr. to 45 min. after pouring.

2b-94. Manufacture of Openhearth Steel to Hardenability Specifications. Frederick M. Washburn. *Proceedings, National Open Hearth Committee, Iron and Steel Division, American Institute of Mining and Metallurgical Engineers,* v. 30, 1947, p. 197-200; discussion, p. 200-201.

Development of satisfactory methods and specifications.

2b-95. Control of Sulphur in the Openhearth. G. L. Plimpton. *Proceedings, National Openhearth Committee, Iron and Steel Division, American Institute of Mining and Metallurgical Engineers,* v. 30, 1947, p. 234-237; discussion 237-245.

Summarizes replies to a questionnaire sent to seven plants in the Chicago district dealing with raw materials, working practices, and quality in relation to sulphur content. Extensive discussion includes prepared contributions by H. L. Allen, W. J. Reilly, A. E. Reinhard, and extemporaneous discussion brought forth by a series of questions. Among the topics considered in the latter are: sulphur pickup from fuel; sulphur elimination with spiegel and ferromanganese; slag basicity and sulphur; effect of lime solution on sulphur; and sulphur from high hot-metal charges.

2b-96. Mold Practice. L. R. Berner. *Proceedings, National Open Hearth Committee, Iron and Steel Division, American Institute of Mining and Metallurgical Engineers,* v. 30, 1947, p. 245-248; discussion, p. 248-252.

Based on a recent survey of mold practice for ingot casting made throughout the steel industry, in an attempt to determine the factors affecting mold life and to bring to light any recent developments or practices that might effect general improvement.

2b-97. Effect of Nozzle Size on Surface Quality of Slab Product of Low-Carbon Rimmed Steel. C. Hunter. *Proceedings, National Open Hearth Committee, Iron and Steel Division, American Institute of Mining and Metallurgical Engineers,* v. 30, 1947, p. 260-264; discussion, p. 264-266.

Previously abstracted from condensation in *Industrial Heating,* v. 14, Nov. 1947, p. 1860, 1862. See item 2-300, R.M.L., v. 4, 1947.

2b-98. Hot Tops in Relation to Ingot Soundness. E. W. Pierce. *Proceedings, National Open Hearth Committee, Iron and Steel Division, American Institute of Mining and Metallurgical Engineers,* v.30, 1947, p. 267-269; discussion, p. 269-272.

Results of experiments made over a 6-mo. period to compare the effect of type of hot top on resulting ingot soundness.

2b-99. Washing or Flushing Acid Openhearth Steel With Inert Gas. P. M. Hulme. *Proceedings, National Open Hearth Committee, Iron and Steel Division, American Institute of Mining and Metallurgical Engineers,* v. 30, 1947, p. 273-278; discussion, p. 278-281.

Results which indicate the value of above procedure for eliminating porosity and hydrogen.

2b-100. Question Period. *Proceedings, National Open Hearth Committee, Iron and Steel Division, American Institute of Mining and Metallurgical Engineers,* v. 30, 1947, p. 297-303.

Basic brick in acid openhearth furnaces; effects of substitutes for pig iron on furnace operation; and changes in charge analyses to take care of reduction of pig iron.

2b-101. Oxygen in the Steel Industry. H. W. McQuaid and F. E. Pavlis. *Iron and Steel Engineer,* v. 25, April 1948, p. 41-46; discussion, p. 46-48.

The need for oxygen generators at the site, capable of producing required quantities at low cost; concerning available commercial equipment of Air Products, Inc., Allentown, Pa. (Presented at A.I.S.E. Annual Convention, Pittsburgh, Sept. 23, 1947.)

2b-102. The Duplex Process. D. T. Rogers. *Iron and Steel Engineer,* v. 25, April 1948, p. 49-57; discussion, p. 57-58.

For the purpose of this discussion, the term duplex refers specifically to the acid bessemer-basic openhearth combination which is the only duplex process of commercial significance in the U.S. today. Background, distinctive characteristics, metallurgical features, and advantages. 11 ref. (Presented at A.I.S.E. Detroit District Section Meeting, March 11, 1947.)

2b-103. Radioactive Tracers in Steelmaking. *Iron Age,* v. 161, April 29, 1948, p. 85.

Use of radioactive sulphur to prove that low pyritic and low organic coals are equally good for the production of steelmaking coke.

2b-104. Steel—How Made and How Much. *Westinghouse Engineer,* v. 8, May 1948, p. 66-72.

For laymen.

2b-105. The Application of Oxygen in the Operation of the Blast Furnace. D. D. Howat. *Blast Furnace and Steel Plant,* v. 36, May 1948, p. 533-538, 592, 602-603.

An investigation to determine benefits accruing from the utilization of an enriched blast and to decide limitations of the process. 11 ref.

2b-106. Practices Affecting Yields and Surface Quality of Rimmed and Semi-rimmed Steel. Leo R. Silliman, *Blast Furnace and Steel Plant,* v. 36, May 1948, p. 550-554.

Data from actual production records to indicate how economies may be obtained by control of certain tangible and fundamental production variables. (To be continued.)

2b-107. Oxygen Enrichment—Its Effect on Openhearths. J. S. Marsh. *Steel,* v. 122, May 3, 1948, p. 112, 115, 118, 120, 122, 125.

A condensation. See abstract of "Combustion Oxygen in the Openhearth", *Iron Age,* v. 161, March 25, 1948, p. 87-89. See item 2b-65, 1948.

2b-108. Note on Further Work on the Phosphorus Reaction in Basic Steelmaking. P. Vajragupta. *Journal of the Iron and Steel Institute,* v. 158, April 1948, p. 494-496.

Range of two previous papers did not quite cover the more basic tapping slags, hence further work was done using two types of slags having high lime-silica ratios.

2b-109. Smelting Under Pressure. Leonard Engel. *Scientific American,* v. 178, May 1948, p. 54-57.

New technique being evaluated by Republic Steel at Cleveland and Youngstown. What takes place in the blast furnace, and how use of pressure can result in a large increase in iron and steel production without corresponding increase in production facilities.

2b-110. Production Flow Charts. Part 4. Electric Furnace Steel, Republic Steel Corporation, South Chicago, Ill. *Factory Management and Maintenance,* v. 106, May 1948, insert between p. 96 and 97.

2b-111. British Experimental Blast Furnace. Tom Bishop. *Metal Progress,* v. 53, May 1948, p. 693.

Furnace and the experimental program planned and under way, which includes effects of oxygen in the blast.

2c—Nonferrous

2c-28. Production of Rarer Metals. George Meister. *U. S. Atomic Energy Commission, MDDC-1673,* Feb. 11, 1948, 11 pages.

Methods for thorium, zirconium, and uranium. Apparatus diagrams. Properties. See item 2c-26, 1948.

2c-29. Vacuum Melting and Casting of Copper. Robert A. Stauffer, Kenneth Fox, and William O. DiPietro. *Industrial and Engineering Chemistry,* v. 40, May, 1948, p. 820-825.

Previous laboratory investigations have suggested that porosity in copper ingots might be reduced by melting and casting in vacuum. Vacuum furnace constructed to conduct tests on 300-lb. melts of copper. Steps in preparing ingots include atmospheric preheating followed by vacuum melting, degassing, and casting. Results of experiments indicated that sound ingots may be produced, that impurities may be removed, and that some of the physical properties of copper can be improved by the process. 10 ref.

2c-30. The Metals of the Platinum Group. C. A. H. Jahn. *Metallurgia,* v. 37, April 1948, p. 307-310.

A condensation. See abstract of "Platinum Metals; A Survey of Their Production, Properties and Engineering Uses", *Metal Industry,* v. 72, March 5, 1948, p. 183-186; March 12, 1948, p. 206-209; March 19, 1948, p. 228-230, 234; March 26, 1948, p. 249-250, 254; April 2, 1948, p. 267-269. Item 2c-23, 1948.

2d—Light Metals

2d-8. Le Dégazage des Alliages d'Aluminium. (Degasification of Aluminum Alloys.) Louis Grand. *Fonderie,* Dec. 1947, p. 975-978; discussion, p. 979.

Various methods were investigated. The influence of degassing on crystal structure and mechanical properties.

2d-9. The Production of Beryllium. Bengt R. F. Kjellgren. *Journal of the Electrochemical Society,* v. 93, April 1948, p. 122-128.

Reduction of beryllium fluoride with magnesium. Impure grades of beryllium oxide are dissolved in aqueous solutions containing ammonium bifluoride. Pure crystals of ammonium beryllium fluoride are produced from the solution. These crystals are decomposed by heating into beryllium fluoride and ammonium fluoride. Metallic beryllium is produced by heating the beryllium fluoride with magnesium. 13 ref. (Prepared for delivery at Columbus, Ohio, meeting of the Society, April 14-17, 1948.)

2d-10. A Recent Development in Metallurgical Technique as Applied to Magnesium Alloys. F. A. Fox. *British Science News,* v. 1, No. 7, 1948, p. 13-15.

The application of a process known as "superheating", to achieve fine-grained castings. Refers to use of hexachlorethane in aluminum-containing alloys to avoid the necessity of superheating and to aid in elimination of hydrogen.

For additional annotations indexed in other sections, see:
7c-16; 27a-78.

(Turn to page 10)

Finishing Equipment

A Year's New Products Designed for Metal Cleaning, Polishing, Protective Coating and Electroplating, as Described by the Manufacturers*

Mechanical Cleaning and Finishing

Tumbling and Blasting

THE OPERATION of tumbling is becoming increasingly important as an economical method of finishing many metal products. Tumbling is most frequently thought of as a foundry process for cleaning rough castings, but it can also be used as an efficient finishing process, in itself, as well as a preliminary treatment to improve base metal surface finish prior to plating. Precision tumbling takes the place of the slow hand deburring operations used for finishing metal parts such as gears, castings, stampings, and threaded parts to exact dimensions and degrees of surface finish.

A product known as Alundum tumbling abrasive has been developed by Norton Co. **(463)*** for this purpose. It is a manufactured aluminum oxide abrasive, which gives a continuous cutting action without glazing and a surface finishing action without addition of any polishing compound. Its heavy weight—a most important factor in tumbling—combined with its toughness and hardness, insures a long life.

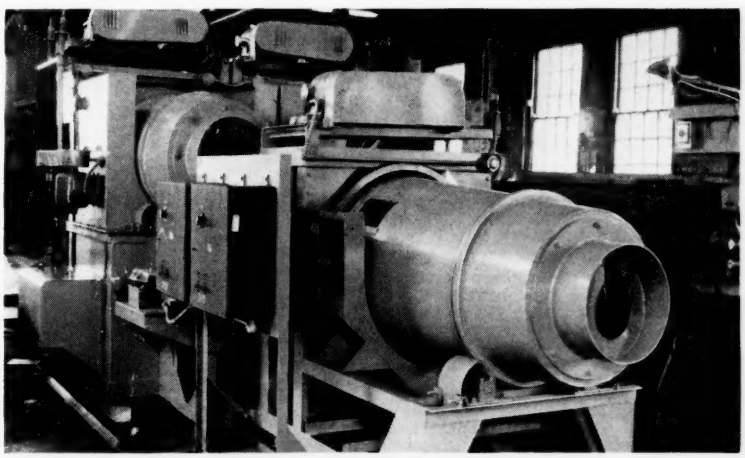
Eight-sided barrels rotated to established time cycles are generally used for tumbling. The barrel contains the parts, the abrasive, water and a cleaning agent. A new Murco tumbling barrel, announced by D. J. Murray Mfg. Co. **(464)** is compact and simply designed. Speed changes may be made while the barrel is in motion, specially designed dump pans are mounted on casters, and separating screens of various mesh wire can be mounted in frames to fit dump pans.

Ball burnishing is a method of producing a high luster on work by rolling down minute surface irregularities; it does not remove any metal, nor is it a cleaning operation. An automatic ball burnishing barrel, complete with sawdust tumbling barrel, has been introduced by N. Ransohoff, Inc. **(465)** as a distinct improvement over the old type, in which the work and the balls had to be separated by hand labor. The work is loaded into one end of this barrel and burnished with a circulating soap solution. After the required length of time, the barrel is reversed and the work automatically discharged onto a vibrating chute which feeds it into the sawdust tumbling barrel; the burnishing balls are automatically removed.

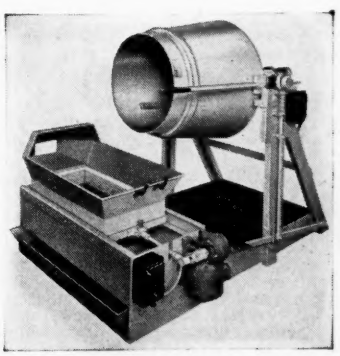
Ransohoff also has a continuous sawdust drying machine **(466)** that dries plated and burnished work automatically and continuously, without hand riddling. A rotating drum 24 in. diameter and 7 ft. long is used. A continuous worm, welded to the inside of the drum, carries the work and sawdust from the charging to the discharge end. The work is polished and dried by the sawdust with which it is gently tumbled. Toward the end of the travel, the sawdust falls through a heavy wire mesh into a retaining jacket where it is heated and dried, and then returned to the charging end of the drum.

The combination steam-heated sawdust barrel and sawdust separator developed by Belke Mfg. Co. **(467)** is used for drying of small parts before and after electroplating. Tumbling action is provided by steel ribs welded to the sides and bottom of the barrel. Work is emptied into the separator by tilting the barrel. The sawdust is sifted into a convenient drawer, leaving the clean work in the hopper.

(*Turn to page* 11)

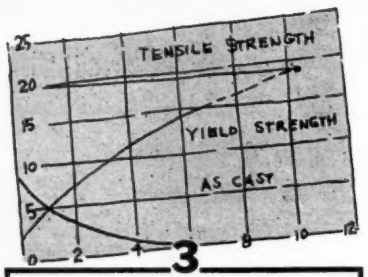


Ransohoff Has Two Automatic Ball Burnishing Barrels Paired With One Sawdust Tumbling Barrel



Combination Sawdust Drying Barrel and Sawdust Separator by Belke

* Complete details about the products described briefly in this article are readily available from the manufacturers. Each of the descriptions carries a number in bold face type. To secure further information, use the Reader Service Coupon on page 21, circling the appropriate number or numbers for the information desired.



3 PROPERTIES

3a—General

3a-44. Laws of Deformation of Solid and Liquid Bodies. (In Russian.) G. Gurevich. *Zhurnal Tekhnicheskoi Fiziki* (Journal of Technical Physics), v. 17, Dec. 1947, p. 1490-1502.

It is shown that Maxwell's well-known equation of relaxation, when exponential dependence of the time of relaxation on stress is assumed, may be used as a first approximation to express the process of deformation of amorphous and crystalline bodies. 15 ref.

3a-45. Abrasion, Erosion and Corrosion; Surface Damage to Metals. I. Berkovitch. *Iron and Steel,* v. 21, April 1948, p. 116.

Recent work on theory and techniques for study of surface structure.

3a-46. Secondary Emission. Part I. L. R. Koller. *General Electric Review,* v. 51, April 1948, p. 33-40.

The phenomenon of emission of secondary electrons, factors influencing yield and distribution, and some ingenious means of measuring them. Tables of values of maximum secondary yield and corresponding voltage of many metals. (To be continued.) 14 ref.

3a-47. Influence of Small Elastic Stresses on the Initial Transformation Susceptibility of Ferromagnetic Substances. (In Russian.) S. V. Vonsovskii. *Zhurnal Eksperimental'noi i Teoreticheskoi Fiziki* (Journal of Experimental and Theoretical Physics), v. 17, Dec. 1947, p. 1094-1105.

Dependence of above susceptibility on low external stresses was established. It is shown that it depends primarily on the magnetic structure of the test specimen, and has maximums and minimums whose locations are defined by the "toughness" of the specimen. 10 ref.

3b—Ferrous

3b-54. La Fonte Pour Pieces Minces. (Cast Iron for Thin Pieces.) Joseph Goffart. *Fonderie,* Dec. 1947, p. 960.

Proposes use of the following chemical composition: Si, 2.55 to 2.75%; Mn, 0.5 to 0.6%; P, 1.0 to 1.2%; graphitic C, 3.0 to 3.15%; combined C, 0.4 to 0.5%; and S, 0.05 to 0.07%.

3b-55. Boron-Treated Steels. *Industrial Heating,* v. 15, April 1948, p. 624, 626, 628, 630.

Work on the interrelationship between boron, carbon, and alloying constituents and some of the properties of steels made in the laboratory and a study of the properties of boron-treated steels of selected chemical composition made commercially under predetermined deoxidizing practices at the National Bureau of Standards.

3b-56. Wear Resistance of Gray Iron Diesel Engine Liners. T. E. Eagan. *Foundry,* v. 76, May 1948, p. 134-139, 308-310, 312.

The influence of structure and composition on wear resistance of gray iron. Results of a series of service tests on 90 different liners of seven different analyses.

3b-57. Tensile Properties Vs. Composition of Double Normalized Cast Steel. H. A. Schwartz and W. K. Bock. *American Foundrymen's Association, Preprint No.* 48-1, 1948, 6 pages.

An empirical equation for calculating tensile strength of double-normalized cast steel from its chemical composition. a critical survey of pertinent literature and an evaluation of experimental data. Deals only with double-normalized acid-electric and basic openhearth steels. (Presented at 52nd annual A.F.A. meeting, Philadelphia, May 3-7, 1948.)

3b-58. Wear Tests on Grinding Balls. T. E. Norman and C. M. Loeb, Jr. *Metals Technology,* v. 15, April 1948, T.P. 2319, 31 pages.

Selection of grinding balls is governed principally by: quality (wear resistance, impact resistance, soundness, and the like); sources of supply and delivered cost; and grinding characteristics or efficiency. Data relative to the fundamental nature of ball wear in ball mills. Development of a suitable wear test and details of procedure for its use. 11 ref.

3b-59. A Laboratory Evaluation of Some Automotive Cast Irons. Arthur B. Shuck. *American Foundrymen's Association, Preprint No.* 48-11, 1948, 27 pages.

Cupola-melted cast irons were examined to evaluate the effect of composition and cross section on mechanical and thermal properties, wear resistance, and microstructure. Test bars, varying in cross section from ¼ to 1½ sq. in. were cast in green sand molds for each of the irons investigated. Several C-Si-base compositions were melted in each type of alloy to determine the effect of variation in carbon and silicon content. Alloy types were: unalloyed; Ni-Cr; Ni-Mo; Cr-Mo; Mo; and Ni-Cr-Mo.

3b-60. Pearlitic Malleable Irons, Plain and Alloyed. Richard Schneidewind and D. J. Reese. *American Foundrymen's Association, Preprint* No. 48-49, 1948, 20 pages.

A study of mechanical properties. Particular emphasis was placed upon the relationship between design strength and toughness as measured by yield point and elongation, respectively. It was found that, with proper heat treatment, the yield points bore a fixed relationship to elongation. Use of alloys coupled with proper heat treatment made possible a 5000 to 10,000-psi, higher yield point for a given elongation than was possible with unalloyed iron. Oil-quenched irons have a higher yield-to-tensile-strength ratio than the air-quenched irons.

3b-61. Nekolik Poznamek k Barkhausenove Zjevu. (Some Notes on the Barkhausen Effect.) Vaclav Sebesta. *Hutnicke Listy* (Metallurgical Topics), v. 3, Jan. 1948, p. 14-15.

Additional experiments connected with the Barkhausen effect in iron wires coated with nonmagnetic materials and on iron-wire coils. The effect becomes less pronounced with coated wires. Recent experiments have shown that the effect does exist at stronger magnetizations, even though to a small extent.

3b-62. Friction of Solid Films on Steel at High Sliding Velocities. Robert L. Johnson, Douglas Godfrey, and Edmond E. Bisson. *National Advisory Committee for Aeronautics, Technical Note No.* 1578, April 1948, 65 pages.

Results of kinetic friction experiments on steel specimens with thin inorganic-solid films over ranges of sliding velocities between 50 and 8000 ft. per min. and loads from 169 to 1543 g. MoS_2 is very effective in reducing friction, and is very tenacious, and chemically and thermally stable. Fe_3O_4 was beneficial on run surfaces whereas α—Fe_2O_3 was not. With films of type formed by e.p.-lubricant additives, $FeCl_2$ was more effective in reducing friction than was FeS. 19 ref.

3b-63. Tests on Flow and Fracture of Welded and Unwelded Tubes of Steel. L. V. Griffis, G. K. Morikawa, and S. J. Fraenkel. *Welding Journal,* v. 27, April 1948, p. 161s-168s, 208s.

Purpose of experimental study was to determine effects of ratio of the principal stresses (from zero to infinity); presence of welded seams; annealing of welded and unwelded material; and temperature and limit of ductile behavior imposed thereby on plastic flow and mode of fracture. Test procedure, including a traversing mechanism for strain measurements.

3b-64. Causes of Cleavage Fracture in Ship Plate—Tests of Wide Notched Plates. A. Boodberg, H. E. Davis, E. R. Parker, and G. E. Troxell. *Welding Journal,* v. 27, April 1948, p. 186s-199s.

Tests conducted at University of California on flat steel plates containing severe notches in an attempt to determine the possible causes of brittle types of failure in all-welded merchant ships. Notched plates of various widths ranging from 3 to 108 in. were tested over a range of temperatures. Three lots were of semikilled ship-quality steel, one of a nickel alloy, one a fully killed steel, and one a quenched-and-drawn steel. Maximum load, load at formation of first crack, load at failure, energy absorption to maximum load, mode of fracture, reduction in area, and strain distribution were determined. It was found possible to produce, under controlled laboratory conditions, brittle cleavage fractures similar to those found in service. Speed of propagation of cleavage cracks ranged from about 200 to 6000 ft. per sec. Microhardness surveys indicated that considerable local plastic flow may precede rupture by cleavage. (Presented at the 28th Annual Meeting, A.W.S., Chicago, Oct. 19, 1947).

3b-65. Explains Steel Hardenability—What It Is, How It's Used. *SAE Journal,* v. 56, April 1948, p. 40-48, 58. Based on "A Present-Day Approach to the Choice and Application of Automotive Steels", by Walter E. Jominy.

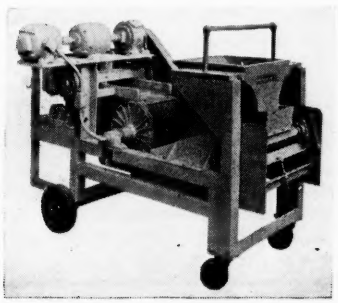
3b-66. Alloying Elements—Effect on Tensile Properties of Malleable Iron. H. A. Schwartz and W. K. Bock. *American Foundryman,* v. 13, April 1948, p. 130-133.

Experimental results indicate that, as expected, any alloy dissolving in ferrite strengthens it. The effects of successive increments of a given element or of the presence of several elements are not directly additive but decrease as the total alloy increases. The effects of several alloys can, however, probably be approximated by converting all into equivalent amounts of a single alloy. Silicon seems to exert an effect on graphite form which may obscure its effect in the matrix. (Presented at 52nd annual meeting, A.F.A., Philadelphia, May 3-7, 1948.)

(Turn to page 12)

Data on the factors to be considered in making a proper choice of a lubricant for use in ball burnishing operations, plus specific recommendations for preparatory cleaning and rinsing procedures, are contained in a special Service Report published by Oakite Products, Inc. **(468)**. Oakite Composition No. 3, used in ball burnishing of steel, brass or aluminum parts, can be added to the barrel dry without preparing stock solutions. It produces a thick suds in either hard or soft water, and rinses freely. It has effective lubricating properties and high resistance to acids carried over from rinses after bright dips.

A special magnetic separator has been designed by Stearns Magnetic Mfg. Co. **(469)** for use in conjunction with tumbling operations. The mixture of steel parts, stones and polishing compounds is fed into a bulk hopper and thence onto a shaker pan feeder. This feeds the parts in a continuous, uniform layer into the magnetic field and underside of a magnetized drum. The steel parts are carried over the drum and through a demagnetizer into a collecting tank. Stones and compound fall off the end of the shaker pan feeder into a suitable receptacle.



Stearns Magnetic Separator

A one-compartment Roto-Finish machine for small deburring and finishing installations has been announced by Sturgis Products Co. **(470)**. The tumbling cylinder is 19 x 32 in. i.d. and has a replaceable lining of hardwood maple.

A combination of tumbling and blast cleaning is incorporated in equipment made by American Wheelabrator & Equipment Corp. **(471)**. A new continuous Wheelabrator Tumblast carries the work through the blast barrel on an endless apron-type conveyor which constantly tumbles and cascades the pieces. All surfaces are thereby exposed to the full effect of the abrasive blast from the overhead Wheelabrator unit. To regulate the speed of travel through the cleaning chamber, the mill is tilted to the proper angle by jack screws.

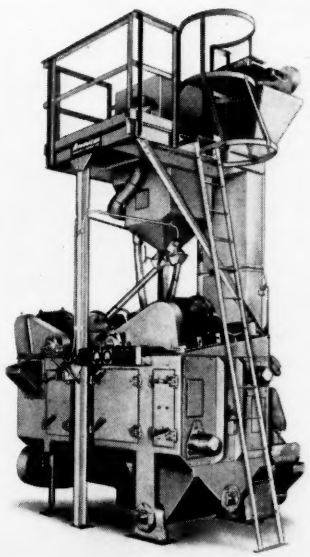
Super Titan Blasting Nozzles

Blasting nozzles known by the trade name Super Titan have been announced by Mills Alloys, Inc. **(472)**. A tungsten carbide liner in these nozzles withstands the wear of abrasive and shot. The jacket may be made of either Kirksite or steel. The nozzles come in lengths of 1 to 6 in., with bores ranging from 1/16 to 5/8 in. in increments of 1/16 in. They may be had with either threaded or socket ends to fit all makes of blasting machines.

Grinding and Polishing Machines

A special abrasive belt head for automatic polishing and buffing is announced by the Packer Machine Co. **(474)**. The head is interchangeable so that one machine can perform various operations using buffs, polishing, tampico and wire wheels, or an abrasive belt.

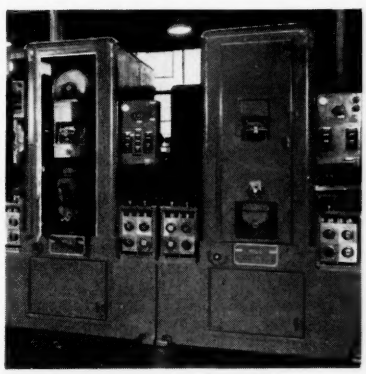
Hill Acme Co.'s two-roll vertical abrasive belt grinding and polishing machines for flat polishing **(475)** have a dynamically balanced upper steel idler roll and a lower rubber-covered contact or work roll over which the abrasive belt travels. The contact roll is the driving roll. These machines are available in three general types: (*a*) strip type, (*b*) plate or bar type, and (*c*) sheet type.



Continuous Wheelabrator Tumblast

An improved Flexspeed variable speed lathe for buffing and polishing is available in 3, 5 and 7½-hp. sizes from Divine Brothers Co. **(476)**. It features a simple handwheel adjustment for changing the spindle speed through a range of 1800 to 3500 r.p.m. With this lathe the correct wheel speed can be set, even on wheels that have been worn down from their original diameter.

Backstand idlers for converting standard polishing lathes to abrasive belt polishing are being marketed by the Manderscheid Co **(477)** and Hammond Machinery Builders, Inc. **(478)**. The Manderscheid Presto unit operates on wall, ceiling, floor or bench, so that additional space is not required. Leaf spring tension with a 12-in. adjustment keeps the belt tight. The Hammond No. 52 is a bench backstand, available for left-hand and right-hand operation.



Hill Acme Co.'s Two-Roll Vertical Abrasive Belt Polishing Machines

Wheels and Buffing Compounds

A new contact wheel for abrasive belt polishing called Beltflex (Divine Brothers Co. — **479**), eliminates the necessity of using buff sections under abrasive belts. The Beltflex wheel has all the advantages of the buff sections, plus controlled balance and density and a smoothly ground surface.

Introduced at the National Metal Exposition last fall, the newest Osborn Buffbrush is used with abrasive compounds for polishing, finishing and burring metal parts. It is made by Osborn Mfg. Co. **(480)** of a special cord locked in by patented ringlock construction. Hard cord is used to remove burrs and sharp edges, and

(*Turn to page* 13)

(Also published as Preprint No. 48-4.)

3b-67. Peeling of Malleable Iron. *Engineering,* v. 165, April 9, 1948, p. 343.

Reviews series of papers and accompanying discussion on above subject, the breaking away of a surface layer under stress, presented at Iron and Steel Institute meeting, London, April 8, 1948.

3b-68. Heat Resisting Steels. L. F. Keeley. *Machinery Lloyd* (Overseas Edition), v. 20, April 10, 1948, p. 68-71.

Composition; scaling and creep; applications.

3b-69. Stabilization of Austenitic Stainless Steel. Samuel J. Rosenberg and John H. Darr. *Journal of Research of the National Bureau of Standards,* v. 40, April 1948, p. 321-338.

Results of a study made of the resistance to intergranular attack of 18% Cr-10% Ni austenitic corrosion resisting steels in 12 different initial conditions. It was found that maximum susceptibility to intergranular attack was developed by sensitizing either 8 or 21 days at 1020° F. The straight carbon austenitic steels were quite vulnerable to attack, although decrease in carbon content decreased the degree of vulnerability. The columbium- and titanium-treated steels were satisfactorily resistant to attack provided the Cb/C or Ti/C ratios were sufficiently high.

3b-70. The Physics of Sheet Steel. (Continued.) G. C. Richer. *Sheet Metal Industries,* v. 25, April 1948, p. 707-715.

The probabilities of translational magnetization are treated. (To be continued.)

3b-71. The Influence of Manufacturing Factors on the Magnetic Properties of Transformer Sheets. (Continued.) G. Delbart, R. Potaszkin, and M. Sage. *Sheet Metal Industries,* v. 25, May 1948, p. 905-910.

Results of commercial-scale experiments. Carbon contents, grain sizes, and depths of recrystallization at various locations within the bar, for various bar thicknesses, ingot weights, and temperatures at end of rolling. (To be concluded.)

3b-72. Replacing Tungsten With Aluminum in High Speed Steels. Roland Mitsche and Emma M. Onitsch. *Metal Progress,* v. 53, May 1948, p. 690-691.

Austrian research. Replacement was believed to be theoretically feasible on the basis of similar atomic radii. Work was centered on the low-alloy steels containing 4% Cr. Comparative lathe tests on five of these steels showed poor performance for a W-free, Cr-Mo-V steel. The same steel with 0.5% Al gave performance about equal to one containing 1.3% W. Performance of a 2.5%-W steel was also duplicated by one containing 1.3% W plus 0.5% Al.

3b-73. Prewar French Experience With Steel Cartridge Cases. E. Herzog. *Metal Progress,* v. 53, May 1948, p. 679-683.

Successful artillery ammunition was made from nonaging 0.10% C steel strip, quenched from within the Ac_1-Ac_3 range, not tempered nor stress relieved after forming into cartridge cases. Close thickness tolerances and very smooth nondecarburized surfaces were also essential specifications. Representative load-elongation curves obtained after various cold-working and annealing treatments, and after 7 firings.

3c—Nonferrous

3c-22. Influence of Stresses on the Hall Effect in Permalloy. (In Russian.) N. M. Genkin. *Zhurnal Eksperimental'noi i Teoreticheskoi Fiziki* (Journal of Experimental and Theoretical Physics), v. 17, Dec. 1947, p. 1090-1093.

Results of an investigation of the effects of plastic and elastic deformation. Hall's coefficient is increased by plastic deformation, but is unaffected by elastic deformation.

3c-23. High Frequency Vacuum Breakdown Tests for Copper and Copper-Plated Ceramic Surfaces. Philip C. Bettler. *U. S. Atomic Energy Commission,* MDDC-1695, Feb. 17, 1947, 4 pages.

The teeth of the rotary capacitor for the University of Rochester frequency-modulated cyclotron are to be made of copper-plated ceramic material. Tests were conducted in a vacuum between copper-plated zircon surfaces. For comparison, solid-copper electrodes were also tested. Data were obtained for both outgassed and fresh surfaces. It was found that the copper-plated ceramic gave about the same results as solid copper.

3c-24. The Institute of Metals. *Engineering,* v. 165, April 9, 1948, p. 340-341.

Continues summary of papers presented at annual meeting (March 1948), and accompanying discussion. The Young's Modulus of Some Aluminum Alloys, by N. Dudzinski and others; The Moduli of Aluminum Alloys in Tension and Compression, by S. F. Grover, W. Munro, and B. Chalmers; and Pressure and Creep Tests at Constant Hoop Stress on Lead and Alloy-"E" Pipes, by A. Latin. (To be continued.)

3c-25. Sintered Alnico Permanent Magnets. *Machinery Lloyd* (Overseas Edition), v. 20, April 10, 1948, p. 101-102.

Properties and applications of this alloy of Ni, Co, Al, and Cu which has a greater magnetic energy per unit volume than any other such alloy.

3c-26. Influence of Various Factors on the Creep of Lead. J. Neill Greenwood and J. H. Cole. *Metallurgia,* v. 37, April 1948, p. 285-289.

Results of some long-time creep tests on pure lead, containing 0.009% total impurities; including influences of stress at ordinary temperature, of stress at 50° C., and of superimposed vibratory stresses.

3d—Light Metals

3d-21. Aluminum-Zinc-Magnesium-Copper Casting Alloys. L. W. Eastwood and L. W. Kempf. *American Foundrymen's Association, Preprint* No. 48-12, 1948, 12 pages.

Tensile properties and hardnesses of the above alloys containing approximately 0.25% Cr and 0.15% Ti were investigated over a range of 0 to 1.75% Cu, 3 to 13% Zn and 0 to 1.0% Mg. Cr and Ti were added for their specific effects on resistance to corrosion and grain refinement, respectively. In sand castings, approximately 0.4% Cu, 6.6% Zn, 0.33% Mg, 0.25% Cr, and 0.15% Ti appear to give good strength and ductility together with satisfactory resistance to corrosion. Castings of this type, however, have the disadvantage of being somewhat "hot short". Tensile properties at elevated temperatures are relatively low. 13 ref.

3d-22. Effect of Titanium on Grain Size and Tensile Properties of an Aluminum-4.5% Copper (No. 195) Casting Alloy. W. E. Sicha and R. C. Boehm. *American Foundrymen's Association Preprint* No. 48-16, 1948, 11 pages.

Effects of 0.05, 0.10, 0.20 and 0.40% Ti. An optimum Ti addition which would produce a very fine grain at any given pouring temperature was found to exist. This amount increased as the pouring temperature was raised. The grain-refining effect is attributed to $TiAl_3$ particles, reduced in size by an incomplete peritectic reaction, which serve as nuclei for starting of crystallization. The additions affect tensile properties in several ways. 10 ref.

3d-23. Effects of Surface Finish, of Certain Defects, and of Repair of Defects by Welding, on Fatigue Strength of 355-T 6 Sand-Castings; and Effects of Prior Fatigue Stressing on Tensile Properties. F. M. Howell, G. W. Stickley, and J. O. Lyst. *National Advisory Committee for Aeronautics, Technical Note No.* 1464, April 1948, 49 pages.

Surfaces studied included as-cast, machined, grit-blasted, and shot-blasted. Unsound conditions included different degrees of porosity and other kinds of defects. Results showed that compositions and tensile properties of the castings comply in general with the requirements of A.S.T.M. and government specifications. 355-T 6 is an Al alloy with a nominal composition of 1.3% Cu, 5.0% Si, and 0.5% Mn.

3d-24. Aluminum-Sheathed Power Cables. *Engineer,* v. 185, April 23, 1948, p. 398-399.

Physical and mechanical properties of aluminum sheathing, and cable characteristics and performance in service. (To be continued.)

For additional annotations indexed in other sections, see:

9b-24; 23b-27; 27a-62; 27c-10.

SPECIAL BRONZES for all chemical and industrial purposes. Castings, rods, and forgings . . 38 years' experience
American Manganese Bronze Co.
Holmesburg, Philadelphia 36, Pa.

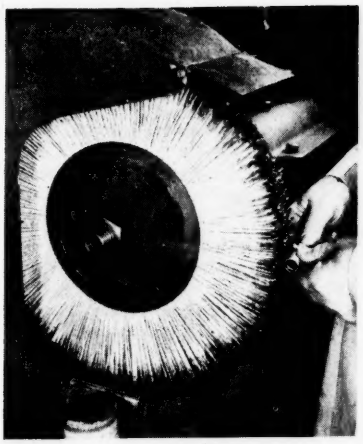
4 CONSTITUTION and STRUCTURE

4a—General

4a-18. Some Problems of the Metallic State. Lawrence Bragg. *Iron and Steel Institute, Special Report* No. 39, "Reports of the Affiliated Local Societies", Dec. 1947, p. 5-7. A condensation.

Factors which influence the behavior of metals from the point of view of the physicist. The structure of a metal is compared to a number of positively charged ball bearings, each coated with insulation in order to retain its charge, and immersed in a conducting liquid of corresponding negative charge. Models in which metal ions are represented by very small bubbles of air floating on the surface of a soap solution are used to represent fundamental phenomena of the metallic state, such as metal-deformation processes. (Presented at meeting of Swansea and

(Turn to page 14)



Osborn Buffbrush Cord Section

soft cord for fine finishes, particularly on irregular surfaces. Sizes range from 6 to 16 in. o.d., and 2 to 7¼ in. i.d.

Sand-O-Flex Corp. **(481)** recently constructed a special machine for satin finishing stainless steel commercial refrigerator door frames, which has eliminated handwork by two operators. Five Sand-O-Flex wheels are mounted on individual pillow blocks, each driven by a belt off a pulley on the main shaft. These blocks are staggered so that each wheel strikes the contour on the edge of the door frame at a successively lower elevation. Only the door frame is moved by being pushed along a track. A No. 80 grit aluminum oxide refill cartridge is used in the wheels.

Two recent bulletins by Hanson-Van Winkle-Munning Co. **(482)** are "Sisalin Sections" and "Polishing Wheels and Accessory Products". The former describes a combined buffing and polishing wheel for fast preparation of steel surfaces for nickel and chromium plating.

Bay State Abrasive Products Co. **(483)** also has a new folder and price list, giving a detailed and pictorial description of Bayflex raised hub disk wheels, their uses and advantages.

The new Hydro-Buff 500 series of buffing compounds recently announced by the Hydro Chemical Co. **(484)** cut and color in the same operation, eliminating the need for rouge. A protective film remains on the piece but is readily removed in the water-phase cleaning cycle of vapor degreasing operations. The compounds are nonflammable and are soluble in all proportion in the chlorinated hydrocarbons.

Acme Scientific Co. **(486)** has inaugurated a precision polishing service for die-casting dies, based on optical lapping and polishing techniques. Dies given this new polish will produce more than 100,000 impressions, the company claims, and since better finish is imparted to the castings, buffing time on the castings is greatly reduced.

Acid and Chemical Cleaning

Cleaning Equipment

An automatic production-line unit for cleaning and paint preparation is typical of the specialized equipment manufactured by Alvey-Ferguson Co. **(487)**. Five operations had to be performed on sheet metal furnace casings 2 ft. wide and 3 ft. high. The machine developed is a 56-ft. long enclosed unit which performs two wash and phosphate coating operations, a clear rinse, a mild chromic acid rinse and a drying operation.

Two parallel overhead conveyors run the entire length of the machine and are separated by a center partition. This is typical of Alvey-Ferguson twin design technique for double production. Pumps, tanks and other facilities serve both sides.

Magnus Chemical Co. **(488)** has recently redesigned its line of Aja-Dip cleaning machines and added several new models. The drive mechanism has been placed in front of the machine for easier access and controls and instruments have been grouped on a panel. The machines operate automatically with a combination agitating and dipping motion.

A drum-type machine for rinsing and drying parts after plating is a new product of Cincinnati Cleaning and Finishing Machinery Co. **(489)**. The parts are fed into a hopper at one end of the machine, cold rinsed, hot rinsed, dried and discharged.

Degreasing and soldering of small parts has been combined into one operation using infrared equipment. The Fostoria Pressed Steel Corp. **(491)** is using the process in the manufacture of localized lighting units. The parts are heated to 520° F. in the trip through the infrared oven, which is adequate for both soldering and degreasing. With this method 480 pieces are soldered, degreased and assembled per hr. Previously soldering was done by electrical induction at the rate of 120 units per hr., and degreasing was a separate operation done in a vapor bath with air drying.

Cleaners and Strippers

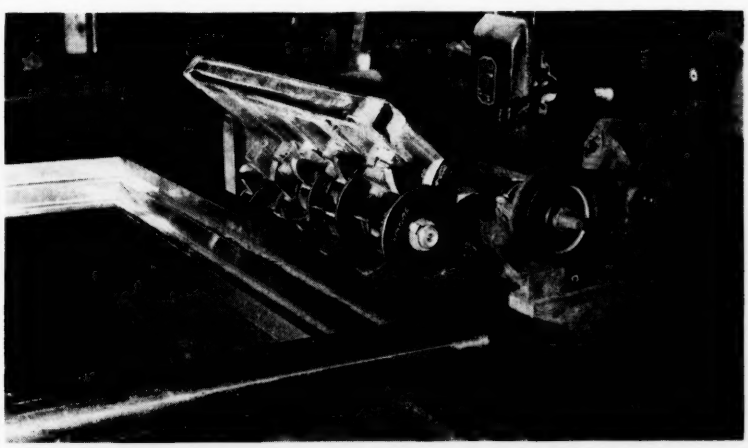
Parker Rust Proof Co. **(492)** has entered the field of metal cleaning by adding a line ot emulsion, acid and alkaline cleaners to its phosphating and other surface preparation materials. They are specialized cleaners to meet varying specifications and conditions, such as water softening, soil removal, rust and grease removal, and conditioning of surfaces for fine, dense Bonderite coatings.

The fast-growing popularity of emulsion cleaning is discussed in a new booklet on solvents by the DuBois Co. **(493)**. It contains information on flash points, boiling ranges, chemical constitution, toxicity and trade names of those solvents most frequently used in metal cleaning.

A new emulsifiable solvent cleaner that dilutes with water for use in pressure spray-type washing machines has been announced by Oakite Products, Inc. **(494)**. Known as Oakite Composition No. 97, it will remove buffing compounds, drawing and stamping compounds, cutting and grinding compounds, mill and slushing oils, other rust preventives, cutting and machining oils, metal chips and shop dirt.

E. F. Houghton & Co.'s Houto-Clean 220 **(495)** is used to replace straight petroleum solvents or nonflammable solvents for industrial cleaning. It leaves a slight oil film

(Turn to page 15)



Sand-O-Flex Machine for Satin Finishing Stainless Steel Frames. Photo by Bob McComb for Weber Showcase and Fixture Co.

District Metallurgical Society, Swansea, England, March 9, 1946.)

4a-19. Gases in Cast Metals. Michael B. Bever. *Iron Age,* v. 161, April 22, 1948, p. 90-94.

The theory of gas-metal interaction and behavior from the standpoints of unsoundness in castings, sources of gases in standard casting operations, solubility of the common gases in various metals and alloys, and factors governing this solubility. Information on control of the reacting and absorbed gases and on nonequilibrium conditions and other aspects of gas-metal behavior. 24 ref.

4a-20. Intermediarni Faze Kovovych Slitin. (Intermediate Phases in Metallic Alloys.) L. Jenicek. *Hutnicke Listy* (Metallurgical Topics), v. 3, Jan. 1948, p. 4-9; Feb. 1948, p. 37-41.

Discusses the concept of chemical phases in metallic systems and its development, the electronic theory of the metallic state, and difficulties encountered in defining the compounds present. 64 ref.

4b—Ferrous

4b-29. Influence of Grain Size on Diffusion of Nitrogen. (In Russian.) A. G. Andreeva. I. E. Kontorovich, and A. A. Sovalova. *Zhurnal Tekhnicheskoi Fiziki* (Journal of Technical Physics), v. 17. Dec. 1947, p. 1521-1526.

It is shown that diffusion of nitrogen into iron increases with grain size. The maximum depth of diffusion of nitrogen is observed after the critical degree of deformation and recrystallization takes place. Depending on grain size, the depth of the diffusion layer increases from 0.26 to 0.60 mm.

4b-30. Fractographic Studies of Ferro-Chromium Alloys. C. A. Zapffe. *Engineers' Digest* (American Edition), v. 5, March-April 1948, p. 105-108.

A condensation. Previously abstracted from *Revue de Metallurgie,* v. 44, March-April 1947, p. 91-96. See item 4-209, R.M.L., v. 4, 1947.

4b-31. Nodular Graphite Structures Produced in Gray Cast Irons. H. Morrogh. *American Foundryman,* v. 13, April 1948, p. 91-106.

See abstract of: "The Production of Nodular Graphite Structures in Cast Iron", H. Morrogh and W. J. Williams, *Journal of the Iron and Steel Institute,* v. 158, March 1948, p. 306-322, item 4b-27, (Presented at 52nd annual meeting, A.F.A., Philadelphia, May 3-7, 1948.) (Also published as A.F.A. Preprint No. 48-46.)

4b-32. Ferromagnetic Structure of Cold Worked Austenitic Stainless Steels. P. T. Hobson and W. P. Osmond. *Nature,* v. 161, April 10, 1948, p. 562-563.

As a result of research on magnetic recording, a new theory is proposed. The idea of a dispersion of ferrite particles, probably long in relation to their cross-section, and of individual volumes of the order of a single domain, in a nonmagnetic matrix of austenite, is supported by experimental evidence.

4b-33. The Carbides in Iron—Carbon—Silicon Alloys and Cast Irons. D. Marles. *Journal of the Iron and Steel Institute,* v. 158, April 1948, p. 433-436.

Results of a metallographic study with Si contents up to 7% and C contents of 1.7 to 3.6%. It was found that with silicon contents in excess of about 2.5%, a carbide phase appears which does not respond to heat-tinting in the same way as normal cementite. With increase in Si up to 7% this phase increases in amount, while the cementite phase decreases until at 7% the carbide phase is a silico-carbide. It has a lower stability at elevated temperatures than normal cementite.

4b-34. Carbide Precipitation in 25-20. David A. Vermilyea. *Metal Progress,* v. 53, May 1948, p. 692.

Photomicrographs show a section from a Type 310 (25-20 Cr-Ni) stainless-steel tube which has been in service at 930° F. for approximately 3000 hr. A specimen from this tube was exposed 50 hr. to a boiling H_2SO_4-$CuSO_4$ solution. No grain-boundary penetration occurred and the specimen withstood a full 180° bend without failure.

4c—Nonferrous

4c-26. A Note on the Forms of the β-Phase Regions in Certain Ternary Alloys of Copper. G. V. Raynor. *Philosophical Magazine,* 7th Series, v. 39, March 1948, p. 212-218.

In many binary alloys with Cu, Ag, Au as solvent, electron compounds with body-centered cubic, close-packed hexagonal, or β-manganese crystal structures are formed at an electron-atom ratio of 3 to 2. Increasing solute valency favors formation of the latter structures, whereas increasing temperature favors the body-centered cubic phases. The latter is also favored by increasing the size-factor of the solute with respect to the solvent. For the systems Cu-Zn, Cu-Al, and Cu-Sn, which are of interest in interpreting the structures of several important copper-rich ternary alloys, the size-factor is positive and increases in the order given. The phase based on CuZn is stable at room temperature. The phases based on Cu_3Al and Cu_3Sn, however, decompose eutectoidally at 570 and 586° C., respectively. Stabilization by increasing size-factor thus appears to outweigh the effect of increasing valency.

4c-27. Equilibrium Relationships in Ternary Alloys. G. V. Raynor. *Philosophical Magazine,* 7th Series, v. 39, March 1948, p. 218-229.

The effect of compound formation on the solid-solubility isothermals of certain Cu and Ag-rich ternary systems, where the extent of the solubility would be governed, in the absence of compound formation, by valency considerations. Conditions under which binary compounds may be expected to enter into equilibrium with the solid solution based on the third element of the ternary system. 12 ref.

4c-28. The Transformation of Cobalt. A. R. Troiano and J. L. Tokich. *Metals Technology,* v. 15, April 1948, T.P. 2348, 12 pages.

Results of an X-ray diffraction study of the cubic-hexagonal transitions of Co, correlating them with data of previous investigators, which have shown considerable disagreement. The transition on cooling is of particular interest. 21 ref.

4c-29. The Effect of Manganese, Iron and Nickel on the α/β Brass Equilibrium. William Hume-Rothery. *Philosophical Magazine,* 7th Series, v. 39, Feb. 1948, p. 89-97.

The forms of the $\alpha/(\alpha+\beta)$ and $(\alpha+\beta)/\beta$ isothermal phase boundaries are discussed for the ternary system Cu-Al-Zn, and for ternary systems of the type Cu-Al-X, and Cu-Zn-X, where X is a transition element. 13 ref.

4c-30. Copper-Lead Alloys. R. W. K. Honeycombe. *American Foundryman,* v. 13, April 1948, p. 113-119.

See abstract of "The Technology of Copper-Lead Alloys", *Section of Tribophysics, Council for Scientific and Industrial Research, Commonwealth of Australia, Physical Metallurgy Report No. 6, Serial No. A158,* Oct. 20, 1947. Item 4c-18. (Presented at 52nd annual meeting, A.F.A., Philadelphia, May 3-7, 1948. Also published as A.F.A. Preprint No. 48-5.)

4c-31. The Disordering of β-Brass by Cold Work. R. W. K. Honeycombe and W. Boas. *Nature,* v. 161, April 17, 1948, p. 612-613.

An investigation. Results of resistivity measurements.

4d—Light Metals

4d-7. The Ternary System: Aluminum-Magnesium-Lithium. Part I. Method of Working With Lithium. Binary Systems. Part II. Phase Diagrams for Additional Cross Sections. (In Russian.) F. I. Shamrai. *Izvestiya Akademii SSSR, Otdelenie Khimicheskikh Nauk* (Bulletin of the Academy of Sciences of the U.S.S.R., Section of Chemical Sciences), Nov.-Dec. 1947, p. 605-615; Jan.-Feb. 1948, p. 83-94.

Methods used in working with Li and results of an investigation of the Mg-Li, Al-Li, and Al-Mg systems. Thermal and microstructural analysis of cross sections at 5, 10, 15, 20, 50, and 60 atomic % Li, and also for the compositions Al_3Mg_4-AlLi and Al-Mg_2Li.

4d-8. Experimental Study of Electron Density in Crystals. Part I. Electron Density of Aluminum. (In Russian.) N. V. Ageev and D. L. Ageeva. *Izvestiya Akademii Nauk SSSR, Otdelenie Khimicheskikh Nauk* (Bulletin of the Academy of Sciences of the U.S.S.R., Section of Chemical Sciences), Jan.-Feb. 1948, p. 17-28.

The f-curve of Al was determined by X-ray diffraction, using certain lines of Fe and Cu as standards and thin specimens obtained by vacuum deposition. A method is proposed for determining optimum temperatures for calculation using the different metals as standards and for extrapolation to other temperatures. The distributions of electron densities in the (001), (011), and (111) directions of the Al lattice were determined by Fourier series analysis at 4000°; and the curve for the (001) direction at 20° was determined by extrapolation. It was shown that the atoms of metallic Al are incompletely ionized. 20 ref.

4d-9. Low Temperature Transformations in Lithium and Lithium-Magnesium Alloys. C. S. Barrett and O. R. Trautz. *Metals Technology,* v. 15, April 1948, T. P. 2346, 23 pages.

General characteristics of above transformations, including the phenomenon of audible "clicks" accompanying certain transformations. Method of sample preparation and diffraction technique used in the study. Effects of cold work and of temperatures down to 63° K. 22 ref.

4d-10. Slip at Grain Boundaries and Grain Growth in Metals. N. F. Mott. *Proceedings of the Physical Society,* v. 60, April 1948, p. 391-394.

A mathematical presentation of a theory for the slip process based on experiments with aluminum.

For additional annotations indexed in other sections, see:

3b-71; 6b-44; 9b-24; 11-90; 18b-56-57; 23b-27; 27a-62.

(Turn to page 16)

on the metal which serves to prevent rusting. A product data sheet gives physical properties and methods of application.

Ahcoloid emulsion cleaner, made by Apothecaries Hall Co. **(496)**, is especially useful for cleaning buffed zinc-base die castings or aluminum parts that would be stained by prolonged immersion in alkali cleaners.

Klem Metal Kleaner No. 159 is a new heavy-duty still and soak tank cleaner of the faster acting type. Klem Chemicals, Inc. **(497)** is the manufacturer. While it was developed chiefly as a general-purpose cleaner, No. 159 has proven especially valuable as a cleaner before galvanizing and porcelain enameling as well as a soak cleaner before plating.

New paint strippers have also been introduced by Klem Chemicals **(498)**. No. 74 is used to remove gilsonite, rubber-base and methacrylate type finishes in sheets, rather than disintegrating them into a powdery film that requires costly hand scrubbing. Klem Kwik Strip No. 75 is a viscous stripper which is effective on all types of finishes, and is harmless to all metals including aluminum and die-cast products.

New strippers for organic finishes that are more powerful than the company's regular enamel strippers have been introduced by Enthone, Inc. **(500)**. They will remove enamels cleanly from aluminum and other active metals without attack. There are seven compositions in the series for various specific uses.

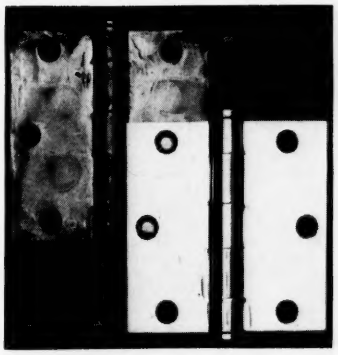
Pickling, Acid Handling

A new, faster-acting Troxide has been introduced by Waverly Petroleum Products Co. **(502)**. Troxide is a pickling compound used as a substitute for sulphuric acid. It is a compound of dry, inert chemicals that become active when dissolved in water. Harmful acid fumes are eliminated by an ingredient known as Protectofoam.

Enthone, Inc., has introduced a new inhibitor, No. 9, the unusual feature of which is that it can be used in both hydrochloric and sulphuric acids **(503)**. It is also odorless and dissolves cleanly in the acid solutions with no formation of sludge, slime or precipitate.

Actane is another new Enthone product **(504)** for use in acid dips prior to plating. It is particularly effective for pickling prior to bright nickel plating. Its function is to disperse and remove colloidal films deposited during cleaning.

American Chemical Paint Co. has a new folder describing its inhibitor known as Rodine **(505)** and Oakite Products, Inc. **(506)** has published a service report containing technical data on specialized acid inhibitors and neutralizing materials used in pickling operations on iron and steel.



Bright Nickel-Plated Hinges. With Regular acid dip on left; with addition of Enthone Actane at right

An electric pump for removing acids, alcohols, bleaches and other liquids from carboys has a pumping speed of approximately 2 gal. per min., according to Belke Mfg. Co. **(507)**. It weighs just 11 lb., and the only part of the unit that touches the acid is a replaceable pipe available in lead, hard rubber or Saran.

A line of unbreakable shop utensils for handling acids, alkalies and other corrosive solutions has been announced by Automotive Rubber Co., Inc. **(508)**. They are manufactured from reinforced, perforated metal, completely covered with a 1/8-in. seamless rubber coating. Pails, dippers, funnels and measures are available.

For heating of pickling tanks, plating solutions, and similar acid applications, Chemical Equipment Division of General Ceramics & Steatite Corp. **(509)** has introduced a line of plate heaters, seven-tube heat exchangers, bayonet heaters and pipe and fittings. The equipment is made of impervious graphite, and has a high resistance to thermal shock and good thermal conductivity.

Protective Coatings

Corrosion Preventives

A corrosion inhibitor for ferrous metals, known as Steelyfe 11 and manufactured by Bee Chemical Co. **(510)**, has as its active ingredient the barium salt of an alicyclic sulphonic acid. It is a water-displacing liquid applied by dipping, brushing or spraying, for indoor storage. It provides a transparent coating that can be removed when desired by wiping or degreasing, even after standing for several years.

Two new types of anticorrosive Zincilate coatings, which will air-dry without baking, have been announced by Industrial Metal Protectives, Inc. **(511)**. The new types are sufficiently flexible so that sheets, pipe and forms can be bent double without breaking the coating. Overcoatings of enamel, paint or wrinkle finishes may be applied over Zincilate after 5 min. of air drying, and both coatings baked at the same time.

Unichrome Clear Dip is a chemical treatment that produces a brilliant conversion coating on ordinary zinc plate. The treated zinc has withstood more than 50 hr. of standard salt spray exposure without dulling or formation of white corrosion products. Dipping time is 5 to 20 sec. at room temperature, preceded and followed by several water rinses. United Chromium, Inc. **(512)**.

A new Black Magic for applying an attractive black finish to zinc plate, zinc alloys and cadmium plate has been developed by the Mitchell-Bradford Chemical Co. **(513)**. Immersion time of 1 to 2 min. is required for zinc; 3 to 5 min. for cadmium plate. It has high abrasion and corrosion resistance, a glossy finish, and, with a 30-sec. immersion, provides a tenacious bond for subsequent paint.

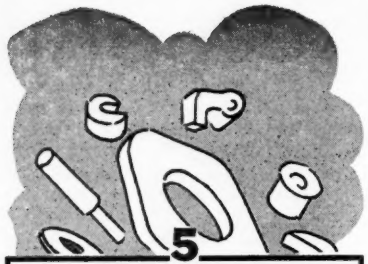
Zinc Alloy Parts Finished With Mitchell-Bradford Black Magic

For copper and copper alloys, Rossaul Copper-Brite, made by Rossaul Co. **(514)**, removes oxides, leaves the metal bright and tarnish resistant as well as passivated and ready for the next operation. It is nontoxic and nonfuming, and will not discolor silver solder.

Several new processes for aluminum finishing have been announced by the Technical Processes Division

(*Turn to page* 17)

For Bulletins and Further Information, Use Reader Service Coupon on Page 21



POWDER METALLURGY

5a—General

5a-20. Production of Ferrous and Nonferrous Metal Powders. G. L. Miller. *Iron and Steel Institute, Special Report No.* 38, Ed. 2 (Rev.), "Symposium on Powder Metallurgy", Dec. 1947, p. 8-14.

Processes used for the production of metal powders are classified in 11 groups. Applications of each method and characteristics of the powder produced by it. A tabulation of methods of production and properties of powders of the common industrial metals.

5a-21. Production of Sintered Permanent Magnets. S. J. Garvin. *Iron and Steel Institute, Special Report No.* 38, Ed. 2 (Rev.), "Symposium on Powder Metallurgy", Dec. 1947, p. 67-72.

Stages in the production of sintered permanent magnets using Fe-Ni-Al alloys. Very good and consistent results have been achieved by using binary alloys of aluminum with iron or cobalt in the preparation of powders, and by taking extreme precautions against oxidation during pressing and sintering.

5a-22. The German Hard-Metal Industry. G. J. Trapp, B. E. Berry, H. Burden, A. E. Oliver, and T. Raine. *Iron and Steel Institute, Special Report No.* 38, Ed. 2 (Rev.), "Symposium on Powder Metallurgy", Dec. 1947, p. 92-98.

Developments in techniques of preparing and processing materials in the manufacture of hard metals. Results of researches into the structure and physical properties of hard metals and their constituents.

5a-23. Notes on German Developments in Noncarbide Powder Metallurgy (1939-1945). C. J. Leadbeater. *Iron and Steel Institute, Special Report No.* 38, Ed. 2 (Rev.), "Symposium on Powder Metallurgy", Dec. 1947, p. 191-202.

A brief survey of developments in production of metal powders, manufacture of sintered components, the types of equipment used in pressing and sintering, research on the mechanism of sintering. 175 ref.

5a-24. The Powder Metallurgy of Porous Metals and Alloys Having a Controlled Porosity. Pol Duwez and Howard E. Martens. *Metals Technology,* v. 15, April 1948, T.P. 2343, 27 pages.

Method of "sweat cooling" for jet-engine parts. An important problem is to develop porous alloys having maximum permeability and minimum porosity, thus achieving maximum tensile strength. Development of a method which consists essentially of mixing a suitable substance with the metal powder, pressing the mixture, and sintering. During heating, but before sintering, the substance dissociates thus creating the desired porosity. Physical properties of a porous stainless steel and a porous Ni-Mo-Fe alloy prepared in this manner.

5a-25. Powder Metallurgy—Its Widening Sphere of Usefulness. Claus G. Goetzel. *Engineers' Digest,* (American Edition), v. 5, March-April 1948, p. 96.

5a-26. High Temperature Materials by Powder Metallurgy. Claus G. Goetzel. *Iron Age,* v. 161, April 29, 1948, p. 78-81.

The need for refractory alloys for parts to be subjected to high temperatures has led to work on materials free from the limitations imposed by casting and forging. Of several powder metallurgy procedures possible, the so-called infiltration technique appears to be the most promising. Metallurgical advantages of this method and also refractory oxides and ceramic components.

5a-27. Mechanism of Sintering. A. J. Shaler and John Wulff. *Industrial and Engineering Chemistry,* v. 40, May 1948, p. 838-842.

The authors conclude that the metal flows viscously under the influence of surface tension and gas pressure. Using a simplified model, rates of shrinkage of copper compacts at 850° C. were calculated and measured. Preliminary measurements confirmed the nature of the mechanism but indicated a slightly higher viscosity coefficient than is predicted on the basis of the self-diffusion coefficient of copper. 18 ref.

5a-28. Friction in Powder Metallurgy. H. W. Greenwood. *Metallurgia,* v. 37, April 1948, p. 283-284.

Effect on the preparation of powdered-metal compacts.

5a-29. Designing Parts Made From Sintered Metal Powder Compacts. Herbert Chase. *Electrical Manufacturing,* v. 41, May 1948, p. 100-105, 136-138.

Specific rules to consider in establishing economic production. Die and product designs.

5b—Ferrous

5b-10. Production of Iron Powder by Electrodeposition. G. E. Gardam. *Iron and Steel Institute, Special Report No.* 38, Ed. 2 (Rev.), "Symposium on Powder Metallurgy", Dec. 1947, p. 3-7.

Experiments on production of iron powder on a pilot-plant scale by electrolysis of 10% ferrous ammonium sulphate solution at 35° C., at a pH of 2.5, and at 200 amp. per sq. ft., half the current being fed through iron anodes and half through lead anodes in porous pots. Preliminary experiments on electrodeposition and grinding of brittle flake iron and electrolytic reduction of ferrous hydroxide.

5b-11. Some Properties of Engineering Iron Powders. C. J. Leadbeater, L. Northcott, and F. Hargreaves. **Determination of Specific Surface of Iron Powders by a Modification of the Air-Permeability Method.** F. M. Lea. *Iron and Steel Institute, Special Report No.* 38, Ed. 2 (Rev.), "Symposium on Powder Metallurgy", Dec. 1947, p. 15-36.

Methods of testing and techniques for determining particle, apparent, and tap densities of the powders, and densities of sintered compacts. Results of a study of surface texture, particle size, shape factor, and crystal structure by microexamination. Oxygen, hydrogen, and nitrogen contents were determined. Properties of commercial powders. Properties of sintered compacts. A summary and comparison of test data. The paper by Lea is an appendix to the first paper. 22 ref.

5b-12. The Nature, Properties, and Applications of Carbonyl-Iron Powder. L. B. Pfeil. *Iron and Steel Institute, Special Report No.* 38, Ed. 2 (Rev.), "Symposium on Powder Metallurgy", Dec. 1947, p. 47-51.

History of development of carbonyl-iron powder. Iron powder made by the carbonyl process possesses outstanding electromagnetic properties. Production conditions, and tentative explanations of the cause of the special form and properties of the powder. 12 ref.

5b-13. Comparison of Magnetic Powder Cores for High and Low Frequencies. G. R. Polgreen. *Iron and Steel Institute, Special Report No.* 38, Ed. 2 (Rev.), "Symposium on Powder Metallurgy", Dec. 1947, p. 52-58.

A comparison of properties of these various cores and of the materials from which they may be constructed.

5b-14. Nickel-Iron Alloy Dust Cores. S. E. Buckley. *Iron and Steel Institute, Special Report No.* 38, Ed. 2 (Rev.), "Symposium on Powder Metallurgy", Dec. 1947, p. 59-63.

Development of dust cores to meet increasing demand for use in telecommunications equipment. Requirements for such uses, a high and constant permeability and low losses in the core being the most important. Use of electrolytic iron, Permalloy (Ni-Fe), and Mo-Permalloy. Constancy of permeability and its influence on design; calculating dust-core permeability from inherent properties of the metal, and core losses. 10 ref.

5b-15. High-Magnetic-Permeability Powder-Iron Components. D. A. Oliver. *Iron and Steel Institute, Special Report No.* 38, Ed. 2 (Rev.), "Symposium on Powder Metallurgy", Dec. 1947, p. 63-66.

Commercial applications of magnetic iron powders and the desirable characteristics. Results of investigations on grading, molding pressure, sintering and temperature.

5b-16. The Properties of Certain Iron Powder Compacts. J. P. Burr and W. Clarke. *Iron and Steel Institute, Special Report No.* 38, Ed. 2 (Rev.), "Symposium on Powder Metallurgy", Dec. 1947, p. 113-116.

Tables of results of experiments to determine effect of length on density of electrolytic iron powders compacted under various pressures and effect of addition of 1% stearin on tensile properties of the compacts. Values for probable pressure losses at the centers of compacts.

5b-17. Iron-Carbon Alloys by Powder Metallurgy. J. A. Judd. *Iron and Steel Institute, Special Report No.* 38, Ed. 2 (Rev.), "Symposium on Powder Metallurgy", Dec. 1947, p. 117-122.

Advantages and limitations with respect to ease of compaction, ease of sintering, decarburization, and die wear. It is concluded that for the higher carbon alloys (hypereutectoid and graphitic steels) there is some advantage in the use of mixtures of iron powder with iron carbide and graphite powder, since iron carbide liquates at sintering temperature, thereby strengthening the bond and improving physical properties. This method may also be used for the incorporation of alloying elements which are normally diffused during sintering only with great difficulty.

5b-18. Pressing, Sintering, Heat Treatment, and Properties of Iron-Graphite Powder Mixtures. R. Chadwick and E. R. Broadfield. *Iron and Steel Institute, Special Report No.* 38, Ed. 2 (Rev.), "Symposium on Powder Metallurgy", Dec. 1947, p. 123-141.

Experimental results for electrolytic powder, a charcoal-reduced Swedish powder, and a German powder made by the Degussa process.

(Turn to page 18)

of Colonial Alloys Co. One is a method and a material for chemical polishing that is nonelectrolytic, fast, simple to maintain and low in cost **(515)**. Material so treated can also be anodized to produce an unusually brilliant coating, either clear or colored.

Another process provides a clear, transparent oxide coating, somewhat on the order of an anodic treatment but not so thick nor abrasion resistant **(516)**. It has good corrosion resistance, and is applied by simple immersion of 30 sec. to 15 min. A variation of this process provides a thicker, opaque coating, applicable to aluminum alloys containing copper.

Paints and Synthetics

C. A. Woolsey Paint & Color Co., Inc. **(517)** is marketing a new Metalast system of painting, said to prevent corrosion of industrial equipment and fouling of ships' bottoms. These paints contain new resins and adhere strongly to all types of metal. The system starts with a washcoat primer—a single coat—then a Metalast anticorrosive, of which two or three coats may be applied within a few hours, and finally the Metalast top coat, which varies according to color desired and usage.

A new Chrome-Aluminum enamel is the result of 18 months of intensive research at the Norfolk Paint & Varnish Co.'s laboratories **(518)**. It gives the effect of polished chromium with the high reflectivity of silver. Because of its good flowing and leafing properties one coat is generally sufficient.

Duco Metalli-Chrome lacquer **(519)** utilizes new pigment materials and techniques to provide a durable finish with rich, lustrous color effects. Free licenses for its manufacture have been granted to 50 paint and lacquer companies by the E. I. du Pont de Nemours & Co.

A Mottle-Chrome finish, based on vinylite resin, has excellent adhesion to aluminum; it is a product of the Brooklyn Varnish Mfg. Co. **(520)**. A one-coat application provides a tough, smooth, nontoxic finish, resistant to normal abrasion and to cleaning agents.

Three new folders on synthetic resin coatings have been released by Nukem Products Corp. **(522)**. One describes Nukemite 24—a solution that can be safely applied over ordinary paints by conventional brush or spray methods, and gives superior resistance to acids, alkalis and other corrosives. Nukemite 40, described in the second folder, is similar to No. 24, but has greater corrosion and abrasion resistance. The third folder gives information on Nukemite 35 Tank Lining, a product developed especially to combine the ease of application of a liquid coating with the immunity and long service life of good sheet membrane linings.

Easier application, without primer, increased corrosion resistance, and durability are among the factors that feature a new product of Lithgow Corp., LC-600 **(523)**. Based on inert synthetic resins, it may be sprayed, dipped, flowed, roller coated, or brushed on almost any clean, unpolished, derusted surface.

Insulating Machined Part Prior to Electroplating, With Scotch Tape Marketed by Minnesota Mining and Mfg. Co.

Stop-Offs; Masking Coats

A colloidal graphite material that acts as a stop-off for selective hot dip tin plating has been developed by Acheson Colloids Corp. **(524)** in conjunction with a large manufacturer of tin-plated bearings. It is easily applied and will withstand a muriatic acid pickling bath as well as the fluxing dip and molten tin dip.

A synthetic coating of extra heavy thickness, announced by United Chromium, Inc. **(525)**, is primarily designed to insulate and protect electroplating racks. This material, marketed as Unichrome Coating 218, contains 100% solids, with nothing to evaporate. It is a baking synthetic applied by dip or spray.

A new Scotch tape designed for wrapping electroplating racks and for blocking off parts is being distributed by Minnesota Mining and Mfg. Co. **(526)**. It is a yellow, pressure-sensitive, plastic-backed tape that withstands prolonged immersion in most electroplating solutions, including hard chromium, without becoming brittle or cracking. It will withstand most hot or cold cleaners, but is not resistant to potash or trichlorethylene cleaners and degreasers.

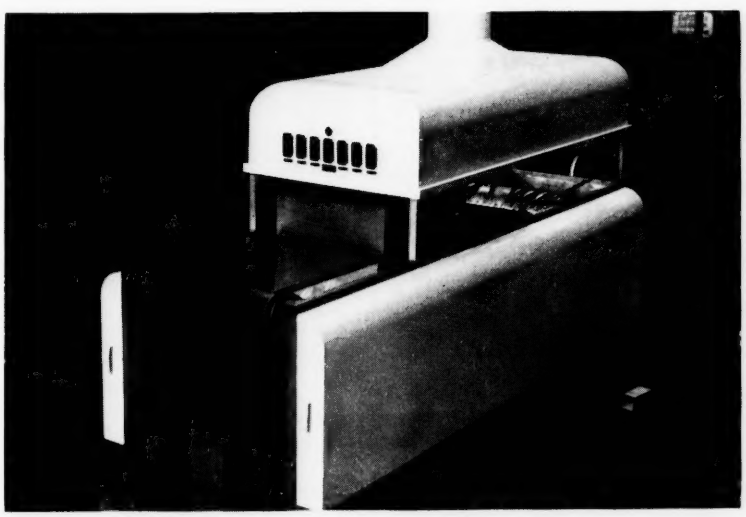
Strippable plastic coatings have been announced by several manufacturers during the past year. Among them is Copeel, made by Maas & Waldstein Co. **(528)** for protecting bare metals and finished parts from rust, corrosion, marring and scratching during transit or storage. It is also water resistant. Peelcote is the trade name given by Watson-Standard Co. **(529)** to a similar air-drying, vinyl-based coating, available in clear transparent or black color. Dennis Chemical Co.'s Redskin **(530)** will protect parts during fabrication as well as in storage and shipping.

Pigmented Filmite, a paint spray booth masking compound made by the DuoBis Co. **(531)** will dry white for maximum light reflectivity. It is heat resistant and can be washed with water, or peeled off when necessary. Detrex Corp.'s Triad PRD **(532)** also dries to a white coating; it is especially advantageous for dry spray booths, but can also be used on wet booths.

Finishing Equipment

An ingenious automatic finishing unit, introduced by George Koch Sons, Inc. **(537)** at the Metal Show last fall, as the Gyra-Flow process, washes, rinses, dries, dips, sprays and bakes in one continuous cycle. A continuous steel belt conveyer trav-

(*Turn to page* 19)



Gyra-Flow Automatic Finishing Unit

5b-19. Observations on the Pressing, Sintering, and Properties of Iron-Copper Powder Mixtures. R. Chadwick, E. R. Broadfield, and S. F. Pugh. *Iron and Steel Institute, Special Report No.* 38, Ed. 2 (Rev.), "Symposium on Powder Metallurgy", Dec. 1947, p. 151-157.

Results of a study made of the effects of variations in particle size, sintering pressure and temperature on properties of Fe-Cu compacts containing up to 35% Cu.

5b-20. German Sintered Iron Driving Bands. W. Ivory. *Iron and Steel Institute, Special Report No.* 38, Ed. 2 (Rev.), "Symposium on Powder Metallurgy", Dec. 1947, p. 203-208.

Size and organization of the wartime production of iron powder and the development, manufacture, and testing of sintered iron driving bands.

5c—Nonferrous

5c-9. Flake Metal Powders—Their Application, Manufacture, and Testing Methods. H. Meyersberg. *Iron and Steel Institute, Special Report No.* 38, Ed. 2 (Rev.), "Symposium on Powder Metallurgy", Dec. 1947, p. 37-46.

Methods of manufacture using the stamp and modified ball mill. Methods used in testing flake powders. Physical properties of flake and granular metal powders.

5c-10. The Preparation of Carbides. L. D. Brownlee, G. A. Geach, and T. Raine. *Iron and Steel Institute, Special Report No.* 38, Ed. 2 (Rev.), "Symposium on Powder Metallurgy", Dec. 1947, p. 73-78.

Methods used for preparation of carbides and double carbides of W, Ti and Ta. Details of typical commercial practice in the manufacture of powders for cemented carbides. 10 ref.

5c-11. The Manipulation and Sintering of Hard Metals. H. Burden. *Iron and Steel Institute, Special Report No.* 38, Ed. 2 (Rev.), "Symposium on Powder Metallurgy", Dec. 1947, p. 78-83.

Main stages in production of a consistent high-quality hard metal from prepared powders to the sintered product. The tungsten-carbide /cobalt group and the titanium-carbide/tungsten-carbide/cobalt group.

5c-12. The Physical Metallurgy of Sintered Carbides. E. J. Sandford and E. M. Trent. *Iron and Steel Institute, Special Report No.* 38, Ed. 2 (Rev.) "Symposium on Powder Metallurgy", Dec. 1947, p. 84-91.

Physical and chemical changes in cemented carbides in relation to the sintering process, the course of which has been followed by measurement of contraction and by microscopic examination. Appearance of other phases in alloys of tungsten carbide and cobalt in relation to the carbon content, and present knowledge of W-C-Co system. 13 ref.

5c-13. The Structure of Porous Bronze Bearings. A. Carter and A. G. Metcalfe. *Iron and Steel Institute, Special Report No.* 38, Ed. 2 (Rev.), "Symposium on Powder Metallurgy", Dec. 1947, p. 99-105.

A brief description of the usual method of manufacture of porous bronze bearings. An attempt is made to correlate the structure, determined by X-ray diffraction methods, with other properties. Some experimental sinterings were carried out on Cu-Sn-graphite alloys, and results obtained by various combinations of compacting pressure and sintering times and temperatures were compared with bearing properties.

5c-14. Highly Porous Metal Compacts, With Special Reference to Filters. C. E. Sinclair. *Iron and Steel Institute, Special Report No.* 38, Ed. 2 (Rev.), "Symposium on Powder Metallurgy", Dec. 1947, p. 105-109.

Their characteristics of flow and pressure-drop relationships of porous filters produced from graded spherical particles, together with micrographs showing pore size and shape. Typical applications and service results.

5c-15. Aircraft Liquid Deicing Equipment. *Iron and Steel Institute, Special Report No.* 38, Ed. 2 (Rev.), "Symposium on Powder Metallurgy", Dec. 1947, p. 110-112.

Conditions for ice formation on aircraft and details of early deicing systems. Development of liquid deicing system incorporating a porous-metal distributor with a sintered Cu-Ni-Sn compact as the porous medium.

5c-16. Sintered Iron-Copper Compacts. L. Northcott and C. J. Leadbeater. *Iron and Steel Institute, Special Report No.* 38, Ed. 2 (Rev.), "Symposium on Powder Metallurgy", Dec. 1947, p. 142-150.

A study of their properties.

5c-17. Powder-Metallurgy Bearing Materials; A Note on Powder-Metallurgy Methods Used in Great Britain for the Manufacture of Plain Bearings and Thrust Washers. W. H. Tait. *Iron and Steel Institute, Special Report No.* 38, Ed. 2 (Rev.), "Symposium on Powder Metallurgy", Dec. 1947, p. 157-161.

Unique qualities of powder-metallurgy methods utilized in production. Materials and methods used for obtaining porous, self-lubricating structures and nonporous structures which are difficult or impossible to manufacture by other means. Recent developments and future prospects. Influence of structure on behavior of Cu-Pb bearings and influence of elastic modulus on the properties of bearing materials.

5c-18. The Pressing and Sintering of Copper Powders. Maurice Cook and S. F. Pugh. *Iron and Steel Institute, Special Report No.* 38, Ed. 2 (Rev.), "Symposium on Powder Metallurgy", Dec. 1947, p. 162-173.

Results and micrographs obtained from a study of copper powders made by a variety of methods. The behavior in pressing and sintering is related to characteristic particle shape and to particle-size grading. Physical characteristics of the powders, compressibility, dimensional changes resulting from sintering, and tensile strength and ductility of sintered products. An explanation is offered for their behavior.

5c-19. The Production of Some Nonferrous Engineering Components by Powder Metallurgy. J. W. Lennox. *Iron and Steel Institute, Special Report No.* 38, Ed. 2 (Rev.), "Symposium on Powder Metallurgy", Dec. 1947, p. 174-184.

Practical significance of results obtained in an investigation of optimum conditions of pressing and sintering for production of the best physical properties in brass and bronze engineering components.

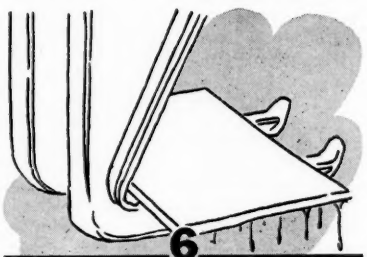
5d—Light Metals

5d-1. Aluminum Components. R. L. Bickerdike. *Iron and Steel Institute, Special Report No.* 38, Ed. 2 (Rev.), "Symposium on Powder Metallurgy", Dec. 1947, p. 185-191.

Experiments on hot and cold pressing and sintering of Cu-Al powders. Results of microscopical examination, density and hardness measurements, and tensile testing. 12 ref.

For additional annotations indexed in other sections, see: 6c-10; 27a-73.

AMERICAN IRON POWDERS
By the pound, ton or carload
SUPERIOR METAL POWDERS CORP.
1011 Pelee St. Toledo 7, Ohio



6 CORROSION

6a—General

6a-41. Les Journées de Corrosion d'Octobre 1947. (Present Tendencies in Research on Corrosion.) Paul Lacombe. *Métaux & Corrosion,* v. 22, Nov.-Dec. 1947, p. 181-184.

New methods for protection against corrosion and for corrosion testing described at International Conference on Corrosion, Paris, Oct. 6-10, 1947.

6a-42. Les Aspects Théoriques de la Corrosion et de l'Oxydation. (Theoretical Aspects of Corrosion and Oxidation.) U. R. Evans. *Métaux & Corrosion,* v. 22, Nov.-Dec. 1947, p. 184-191; discussion, p. 191.

A theoretical development based on Wagner's equation. 29 ref.

6a-43. Mécanisme des Inhibiteurs de Corrosion. (Mechanism of Action of Corrosion Inhibitors.) Herbert H. Uhlig. *Métaux & Corrosion,* v. 22, Nov.-Dec. 1947, p. 204-210.

Fundamental principles. 33 ref.

6a-44. Corrosion Tests of Heater-Tube Materials for Acid Concentration Service. H. F. Brown. *Oil and Gas Journal,* v. 46, April 29, 1948, p. 134-137, 149.

Results of tests on a variety of materials in a laboratory concentrator for H_2SO_4. Materials evaluated were: cast 12-14% Si iron; Si-Ni alloy; Fe-Mo-Ni alloy; glass-coated carbon steel; silver and silver-coated steel; and tantalum. No completely satisfactory materials were found.

6a-45. Fluorine Corrosion. W. R. Myers, and W. B. DeLong. *Chemical Engineering Progress* (Transactions Section), v. 44, May 1948, p. 359-362.

First section deals with corrosion of a number of metals and alloys by hydrogen fluoride and by hydrogen fluoride-steam mixtures at elevated temperatures; second section gives results of an investigation on behavior of steel parts anodically charged in an electrolyte of $KHF_2 \cdot HF$ at 90° C. 11 ref.

6a-46. Corrosion. Mars G. Fontana. *Industrial and Engineering Chemistry,* v. 40, May 1948, p. 95A-96A.

(Turn to page 20)

els spirally around a series of horizontally mounted rotating drums. The work is held to the belt by removable spring-type clips. Timing is regulated by selective belt speed, together with the number of spiral turns around each drum. Loading and unloading may be manual or automatic.

The Scroll-Aire oven heater produced by Newcomb-Detroit Co. **(538)** is applicable to paint drying ovens and other industrial processing. It is a direct gas-fired heater which mixes the products of combustion directly into the air stream. It is a packaged heating system, with gas manifold, combustion air manifold, temperature and safety controls installed at the factory before delivery.

Harper J. Ransburg Co. **(539)** has introduced a new safety control for its electrostatic spray coating and dip-detearing processes. This is an electronic spark-guard that will anticipate an accidental short and de-energize the electrostatic field before a spark-over develops. It will automatically stop the equipment should a piece accidentally approach the discharge electrode.

Porcelain Enamel

A new zirconia base opacifier for porcelain enamels has been placed on the market by the Rohm & Haas Co. **(533)**. It contains a mixture of controlled crystalline phases of zirconia, which, in addition to imparting opacity, provide nuclei for the crystallization of zirconia from the molten enamel. It should find extensive use where maximum gloss and opacity are required along with high impact strength and scratch resistance.

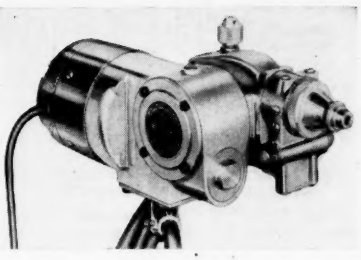
Two testing instruments recently introduced to the porcelain enameling industry by General Electric Co. are the recording spectrophotometer **(534)** and the film thickness gage **(535)**. The spectrophotometer will test a color sample against a standard in approximately 2½ min., and record on a graph the characteristics of the sample as compared to the standard. The film thickness gage is based on the magnetic properties of the base metal, and can be used to test the center of large enameled areas.

A testing apparatus for measuring the adherence of porclelain enamel to base metals by means of magnetic counting has been developed by the research foundation of the Porcelain Enamel Institute **(536)** in the National Bureau of Standards. The test head contains 169 spring-actuated steel probes, individually connected to the selector switch. The probes adjust to the contour of the test area, and if one of them comes in contact with exposed metal, a relay activates the magnetic counter. It is designed to supplement the conventional fracture test for adherence, and measures the degree of fracture by determining the area of exposed metal on the test surface.

Spraying and Spray Guns

Metallizing without preparation is a fact when using Metco Sprabond, a metal which may be sprayed directly onto smooth, highly polished steel and many other materials, according to Metallizing Engineering Co., Inc. **(540)**. Only three steps are necessary to build up a worn shaft, namely, rough turn the shaft, apply just enough Sprabond to cover fuly, substitute for the Sprabond wire in the gun the desired finish material and proceed with the work.

Metallizing Engineering Co.'s latest model, the L gun **(541)** uses only 10 cu. ft. of air per min. New turbine construction requires only one-third the power, and new nozzle construction keeps consumption of acetylene and oxygen low. The turbine control requires only one adjustment for a full range of metallizing wires.



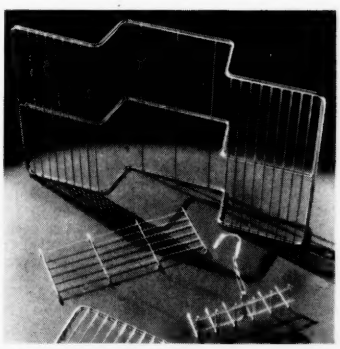
Mogulectric Metal Spray Gun by Metallizing Co. of America

Metallizing Co. of America **(542)** has developed a new gun powered by an electric motor and called the Mogulectric metal spray gun. It is the answer to production-line spraying or other conditions requiring top speeds. By using an electric drive, air requirements are materially reduced and turbine adjustments are eliminated.

Electrofinishing

A new and economical method for electrolytic polishing of stainless steel is described by E. I. du Pont de Nemours and Co. **(543)** in an operating manual. A solution of glycolic acid, sulphuric acid and water is used; this solution remains liquid at room temperature and operates over a wide range of current densities.

Armco Steel Corp. **(544)** has also demonstrated an improved electropolishing process for stainless. The solutions used are citric-sulphuric acid or glycolic-sulphuric acid at 158 to 200° F., or a solution of phosphoric acid and butyl alcohol at 140 to 160° F. On cold drawn stainless steel wire products, only 2 to 8 min. in the tank was necessary for a good polish.



Electropolished Stainless Steel Wire Parts—Armco Steel Corp.

An improved bright cadmium plating process was announced last fall as the Cadux HS process by Hanson-Van Winkle-Munning Co. **(545)**. An outstanding feature of the process is its tolerance for impurities. The range of the bath is from 20 to 40 amp. per sq. ft. with an optimum current density of 30 to 35 amp. per sq. ft. in still plating. With agitation, current densities up to 70 amp. per sq. ft. have been employed.

Chromium plating is treated in a new 36-page profusely illustrated catalog issued by Chromium Corp. of America **(546)**. Performance that might be expected under known operating conditions is detailed, together with characteristics and applications.

For copper plating, MacDermid, Inc. **(547)** has developed a new stop-off material known as Rocheltex. Its unique advantages are described, along with instructions for its use, in Technical Data Sheet No. 5.

Anodes and salts for electroplating are listed in a handsome 32-page catalog of Harshaw Chemical Co. **(548)**, which relates the history of the organization and its major activities, and also lists industrial chemicals for other purposes.

Tanks and Anodes

A Mercil-type all-purpose plating barrel, introduced by Hanson-Van Winkle-Munning Co. **(549)** uses a new material for the cylinder. Known as Merlon, it incorporates resins which stand up at temperatures of 190 to 200° F. It is resistant to hot caustic solutions as well as low-concentration acid baths. Consequently, the cylinders can be used through hot cleaner, rinse, acid dip, rinse and both cyanide and acid plating baths. Merlon is also highly resistant to abrasion.

(*Turn to page* 21)

Importance of design of equipment in preventing and minimizing corrosion and costs of its prevention.

6a-47. Cathodic Protection of Buried Metallic Structures Against Corrosion. *Journal of the American Water Works Association,* v. 40, May 1948, p. 485-488.

Bulletin No. 1 of a series to be prepared by the Correlating Committee on Cathodic Protection.

6a-48. Principles of Cathodic Protection Design. L. P. Sudrabin and Frank P. Macdonald. *Journal of the American Water Works Association,* v. 40, May 1948, p. 489-494.

Basic principles, general design considerations, selection of equipment, and design comparisons. (Presented at joint meeting of Cuban and Florida Sections American Waterworks Assoc., St. Petersburg, Fla., Nov. 20, 1947.)

6a-49. Sulphuric Acid Versus Construction Materials. *Chemical Engineering,* v. 55, May 1948, p. 235-236, 238, 240, 242, 244.

Part I of a symposium in which typical materials of construction are evaluated for services involving sulphuric acid. Includes the following brief articles: Rubber Linings, by O. S. True; Cast Iron and Steel, by Albert W. Spitz; Worthite, by E. T. Collinsworth; Hastelloy, by C. G. Chisholm; and Stainless Steel, by W. G. Renshaw.

6b—Ferrous

6b-37. Recherches sur la Corrosion des Fontes par l'Aluminium et les Alliages Légers au Silicium (Alpax et Hypersiliciés Liquides). (Investigation of Corrosion of Cast Iron Molds by Aluminum and Nonferrous Alloys Containing Silicon. ["Alpax" and Liquid High-Silicon Alloys.]) Paul Bastien and Suzanne Daaschner. *Fonderie,* Dec. 1947, p. 962-964; discussion, p. 964-965.

Ordinary gray cast iron proved most satisfactory with respect to corrosion caused by liquid aluminum. In the case of "Alpax" or high-silicon alloys in the liquid state, the best results were obtained with malleable cast-iron molds.

6b-38. Zinc Anode Protection Installed During Pipe-Line Construction. Otha C. Roddey. *Oil and Gas Journal,* v. 46, April 22, 1948, p. 87-88, 105.

Use of the distributed-anode method and its advantages over other methods.

6b-39. Cathodic Protection of Steel Surfaces in Contact With Water. Leon P. Sudrabin. *Water & Sewage Works,* v. 95, April 1948, p. R109-R121.

Fundamental principles, recommended procedures, and some test results showing effects of different factors. 44 ref.

6b-40. Investigation on Corrosive Matter in Meters. Stanley Jones and J. A. Speers. *Gas Journal,* v. 254, April 7, 1948, p. 40.

Results of a study of the effects of ammonia in the gas on corrosion of tinplate.

6b-41. Cathodic Protection of Steel in Hot Water by Alloys of Magnesium, Zinc, and Aluminum. R. R. Rogers and G. E. Viens. *Canadian Mining and Metallurgical Bulletin,* April 1948, p. 216-224. (*Transactions,* v. 51, 1948.)

The degree of cathodic protection of steel and the anode-corrosion rate were determined for anodes and waters of different compositions at temperatures similar to those in domestic hot-water tanks. 20 different anode materials, 16 of them Mg-Zn-Al alloys, were immersed in different synthetic waters resembling those to be found in various parts of Canada.

6b-42. Behavior of Experimental Zinc-Steel Couples Underground. Irving A. Denison and Melvin Romanoff. *Journal of Research of the National Bureau of Standards,* v. 40, April 1948, p. 301-313.

An investigation on the behavior of Zn anodes for the protection of iron and steel cathodically in eight diverse soil environments. The experimental unit consisted of a small steel ring to which was connected from one to three Zn cylinders to provide different area ratios of Zn to steel. Corrosion of the steel cathodes was prevented over the test periods of from approximately 3 to 6 years except in one poorly conducting soil and in a very alkaline soil. 13 ref.

6b-43. The Mechanism of Protective Action of Alloying Elements in the Sulphide Corrosion of Iron. P. V. Geld and O. A. Essin. *British Chemical Digest,* v. 2, April 1948, p. 225-227. Translated and condensed from *Journal of Applied Chemistry,* (U.S.S.R.), v. 19, No. 9, 1946.

Diffusion coefficients on basis of protective action of alloying elements, alloying elements with a similar affinity for S as for Fe, and alloying elements with higher affinity for S than for Fe.

6b-44. Hydrogen Attack on Carbon Steels. T. C. Evans. *Mechanical Engineering,* v. 70, May 1948, p. 414-416.

Investigations conducted on plant equipment from which it is concluded that straight low-C steels containing from 0.10 to 1.35% C are susceptible to hydrogen attack at pressures of 350 psi. and temperatures above approximately 300° C.

6b-45. Effects of Hydrogen Generated by Corrosion of Steel. M. H. Bartz and C. E. Rawlins. *Corrosion,* v. 4, May 1948, p. 187-206.

Various examples of embrittlement of hardened steel parts and blistering of unhardened parts of petroleum-processing equipment. Recommendations for control of hydrogen damage by various methods including use of corrosion-resistant materials and protective coatings; use of steel as free as possible of inhomogeneities; control of H_2S; elimination of corrosion promoters; use of inhibitors; and control of diffusion. 18 ref. (Presented at annual N.A.C.E. meeting, St. Louis, April 5-8, 1948.)

6b-46. Effect of Atmospheric Corrosion on Maintenance and Economics of Overhead Line Hardware and Guy Strand. Part 2. C. J. Couy. *Corrosion,* v. 4, May 1948, p. 207-218.

Considerations of the effect of corrosion decay on structural strength. Effect of different periods of exposure. Charts and equations for determining optimum cross-sectional dimensions and optimum frequencies of inspection. (To be concluded.) (Presented at annual meeting, N.A.C.E. Chicago, April 7-10, 1947.)

6b-47. Salt Water Corrosion of Ships. R. A. Pomfret and L. M. Mosher. *Corrosion,* v. 4, May 1948, p. 227-243.

Fundamental principles which are applied in modern shipbuilding practice to minimize corrosion damage, and consequences when these precautions are not observed. (Presented at annual meeting, N.A.C.E., St. Louis, April 5-8, 1948.)

6c—Nonferrous

6c-10. Experiments on the Corrosion Resistance of Porous Bronze Compacts Produced by Powder Metallurgy. M. M. Hallett. *Journal of the Society of Chemical Industry,* v. 67, Feb. 1948, p. 57-61.

Test results using a range of acids, alkalis, and salts, under aerated conditions, and in some cases under stagnant conditions, in comparison with the resistance of solid bronze under the same conditions. The corrosion resistance of the two types of material did not differ greatly in many cases, but in caustic soda and in concentrated sulphuric acid, major differences appeared, which were studied in greater detail.

6c-11. Quantitative Evaluation of Corrosive Conditions. W. F. Bonwitt and I. Eisen. *ASTM Bulletin,* March 1948, p. 84-88.

Test using a copper foil in order to calibrate the effect of natural corrosion and of several artificial accelerated corrosion procedures on a metal by observation of electrical resistance.

6c-12. Principes Chimiques et Thermochimiques de la Corrosion des Métaux dans une Solution Aqueuse, Démontrés par l'Exemple du Zinc. (Chemical and Thermochemical Principles of Metal Corrosion in Aqueous Solution Demonstrated on Zinc.) W. Feitknecht. *Métaux & Corrosion,* v. 22, Nov.-Dec. 1947, p. 192-203; discussion, p. 203.

Study of an example of zinc corrosion in chloride solution showed that the corrosion phenomenon cannot be understood without taking into consideration chemical, thermochemical, and electrochemical factors. 15 ref.

6c-13. Dezincification and Erosion-Corrosion. Mars G. Fontana. *Metal Progress,* v. 53, May 1948, p. 686-689.

Third part of a four-installment article on "The Eight Forms of Corrosion".

6d—Light Metals

6d-10. Oxide Films on Metals. Part III. Electronographic Investigation of Oxide Films Formed on Aluminum Under Conditions of the Gaseous Discharge. (In Russian.) P. D. Dankov and D. V. Ignatov. *Izvestiya Akademii Nauk SSSR, Otdelenie Khimicheskikh Nauk* (Bulletin of the Academy of Sciences of the U.S.S.R., Section of Chemical Sciences), Jan.-Feb. 1948, p. 29-39.

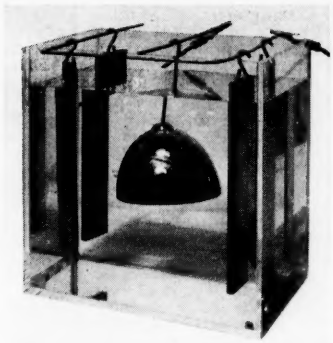
The structure and mechanism of oxide-film formation on Al were studied using glow discharge, both cathodic and anodic oxidation being investigated. Such oxidation was infinitely more rapid than molecular oxidation. Cathodic oxidation was faster than anodic, and the cathode film had a more regular structure (that of γ-Al_2O_3) than the anodic film which had a structure resembling that formed by air oxidation at room temperatures. Conclusions regarding the role of the electrical field in electrolytic oxidation and regarding differences between the mechanisms of air and electrolytic oxidation. 10 ref.

6d-11. The Corrosion of Metals. Part IX. Magnesium and Its Alloys. (Concluded.) *Sheet Metal Industries,* v. 25, April 1948, p. 963-970, 978.

Effect of heat treatment, including annealing temperature; effect of alloying constituents; effects of impurities; resistance to outdoor exposure, to salt solutions and sea water, to nonaqueous solutions, and to leaded gasoline. 13 ref.

6d-12. Magnesium for Cathodic Protection of a Municipal Piping System.

(Turn to page 22)



Singleton-Welded Lucite Tank

A process of welding high-temperature lucite removes a serious obstacle to the use of this material for plating tanks, according to Singleton Co. **(550)**. It is a pure weld of the material and adds no foreign ingredients. Singleton lucite tanks have tensile strength up to 10,000 psi., are resistant to all acids and alkalis, and are transparent.

A new bulletin by Belke Mfg. Co. **(551)** describes rod agitators for electroplating tanks and tells how they reduce plating time, cause more uniform deposits, and effect savings in material and current. A second new Belke bulletin describes variable-speed, semi - automatic conveyers **(552)**. The importance of filtration of electroplating solutions is emphasized in a new catalog by Alsop Engineering Corp. **(553)** on sealed-disk filters and Centri-Poise pumps.

A new form of zinc anode, now being manufactured by Wagner Brothers, Inc. **(554)** is known as Flat Top because of its shape. Its distinctive appearance prevents accidental confusion with cadmium or tin ball anodes, thus avoiding mixing of plating solutions. The effective plating area is 20 to 25% greater than a ball of like diameter.

Manufacturing economies in production of a twin zinc ball anode have been introduced by Udylite Corp. **(555)** and are being passed on to the consumer in a lowered price. The twin unit is cast by a new high-production method that results in considerable savings.

Lead anodes are being equipped with cast copper hooks for the first time, according to Division Lead Co. **(556)**. Used on Divco 71-point lead anodes, the copper hooks double the current-carrying capacity. The cast design retains the special shape which facilitates handling.

Electrical Equipment

A pulse selector is being manufactured by Hill Cross Co. **(559)** for periodic reversing of direct current. Two synchronous motor timers are coordinated to actuate instantaneous changeover between paired power circuits. Each timer may be set to close its circuit for any time period between ¾ and 15 sec. A toggle switch turns the unit on and off, another reverses the direction of alternate pulses, and a third selects continuous or pulsing current.

Columbia Electric Mfg. Co. **(560)** has two new bulletins on cast grid-type tank rheostats for electroplating control, and motor-generator sets for electroplating applications.

A new 9-volt, 2500-amp. selenium rectifier has been introduced by the Bart-Messing Corp. **(561)**. This unit is designed to give a reserve of voltage when using dilute solutions of chromic acid or other baths so as to conserve critical materials.

Selenium rectifiers with 36-position tap switch controls have been announced by Richardson-Allen Corp. **(563)**. While they do not permit the extremely fine settings possible with the stepless variable controls which the company features in other equipment, they do offer a definite economic advantage where minute settings are not required.

The Seletron Division, Radio Receptor Co., Inc. **(564)** has introduced a line of selenium power rectifiers available through jobbers. A bulletin describes ranges of voltage and current, and lists electrical characteristics and dimensions.

Electroplating Accessories

Heated tanks with a completely flat interior surface and without any protruding coils are now possible through a new development of Kold-Hold Mfg. Co. **(565)**. It is called a Platecoil, and has a flat surface on one side with embossing on the other to form channels for the circulation of the heating agent. This construction eliminates internal tubing, reduces weight per sq. ft., and simplifies installation. The flat surfaced plates can be formed and welded as part of the tank bottom, sidewalls or both.

Wagner Bros. Flat Top Zinc Anode

A new fume separator that cleans contaminated air without the loss of room heat has been developed by the Industrial Electroplating Co., Inc. **(566)**. The control unit draws the air away from the tanks, cleans it by water absorption and centrifugal separation, and returns pure air, still warm, to the shop. A minimum of ductwork is required.

A new chromic-sulphuric acid fraction meter will soon be placed on the market by Cro-Micron Process & Research Corp. **(567)**. It will look and operate much like a pH meter, and will enable the shop plater to determine electrically within 30 sec. the exact ratio of chromic acid to sulphuric acid in a chromium bath. The CrO_3:H_2SO_4 ratio is read directly on the meter.

Another instrument, useful for checking the purity of cleaning or plating solutions, is the flame photometer made by the Perkin-Elmer Corp. **(568)**. It is designed to determine quantitatively the percentage of various alkali metals in solution.

READER SERVICE COUPON

Check These Numbers for Production Information and Manufacturers' Catalogs. These following numbers refer to the new products and bulletins listed in the article on "Finishing Equipment" starting on page 9.

THIS COUPON IS VOID AFTER SEPT. 15, 1948

Metals Review, June 1948

463	470	478	486	494	503	510	517	525	533	540	547	554	563
464	471	479	487	495	504	511	518	526	534	541	548	555	564
465	472	480	488	496	505	512	519	528	535	542	549	556	565
466	474	481	489	497	506	513	520	529	536	543	550	559	566
467	475	482	491	498	507	514	522	530	537	544	551	560	567
468	476	483	492	500	508	515	523	531	538	545	552	561	568
469	477	484	493	502	509	516	524	532	539	546	553		

YOUR NAME .....

COMPANY ..... **TITLE** .....

STREET ..... **CITY AND ZONE** .....

MAIL TO METALS REVIEW. 7301 EUCLID AVE., CLEVELAND 3, OHIO

K. D. Wahlquist and Oliver Osborn. *Journal of the American Water Works Association*, v. 40, May 1948, p. 495-503.

Ability of magnesium to halt corrosion, theory and practice of its use, its natural advantages and its economic aspects, based on observations of a proven installation at Lake Jackson, Tex. (Presented at Michigan Section Meeting, American Waterworks Assoc., Bay City, Mich., Sept. 19, 1947.)

For additional annotations indexed in other sections, see: 3a-45; 11-92-95.

7 CLEANING and FINISHING

7a—General

7a-92. Radiant Heat; The "Rapiradia" Car Stoving System. *Automobile Engineer*, v. 38, Jan. 1948 p. 14.

System for baking finishes on automobile bodies.

7a-93. Painting Diversified Metal Products. K. E. Williams. *Industrial Finishing*, v. 24, April 1948, p. 42-44, 46, 48, 50, 52.

Surface treatment before painting and the technique of applying different finishes to space and water heater, oil burners, and car loaders.

7a-94. Finishing for Wringer Components of Washing Machines. Walter Rudolph. *Industrial Finishing*, v. 24, April 1948, p. 64-66, 70, 72, 74.

Use of two conveyer lines, each taking care of a different kind of finishing setup—one for applying and drying a dip coat of clear lacquer, and the other to spray a coat of white enamel.

7a-95. A Finishing Process—Coating With Flock. C. C. Fairweather. *Industrial Finishing*, v. 24, April 1948, p. 79-80, 82, 84.

Process produces colorful velvet and suede-like coatings of various types on miscellaneous products in wood, metal, glass, and paper.

7a-96. The Fusibility and Expansion Coefficient of Glass. J. M. Stevels. *Sheet Metal Industries*, v. 25, April 1948, p. 759-765.

Deals in a fundamental manner with fusibility and expansion properties of glasses or vitreous enamels which are of importance to the practical enameler. The arrangement of the atoms in crystal structures found in glasses.

7a-97. Metal Cleaning Processes—Part III. Varying Treatments for Special Needs. L. Sanderson. *Chemical Age*, v. 58, April 3, 1948, p. 459-461.

(To be continued.)

7a-98. Printing Replaces Hand Filling of Embossed Surfaces. H. O. Bates. *American Machinist*, v. 92, April 22, 1948, p. 89.

Replacement of costly hand application of enamel to embossed work by use of a molded synthetic-rubber die.

7a-99. The Deposition of Pure Boron. Part I. A Static Method for the Preparation of Boron Coatings. H. I. Schlesinger, George W. Schaeffer, and Glen D. Barbaras. *U. S. Atomic Energy Commission*, MDDC-1338, May 24, 1944, 26 pages.

The procedure most frequently used by the authors consisted of heating the object to be coated in a static atmosphere of diborane. By repetition, deposits of the required thicknesses were obtained. Deposition occurs at temperatures between 400 and 600° C. It can be easily adapted to large-scale operations. Deposits can be obtained on glass, Al, Fe, Cr, Ag, Ta, Mo, Pt, W, as well as on the alloys chromel, alumel, and constantan; and may be any desired thickness up to 10 mils. 19 ref.

7a-100. An Analysis of the Polishing Problem. W. H. Sawyer. *Journal of the Electrodepositors' Technical Society*, v. 23, 1948, p. 59-78 (Reprint.)

"The polishing problem" lies not only in the polishing shop but is affected by each successive stage of fabrication. Problems of design, in the foundry, in forging, in ingot casting, in rolling, in the press shop, in machining, in soldering and brazing, and in plating, in relation to effects on the polishing operation. (Presented at Annual Conference, The Society, Birmingham, England, April 15, 1948.)

7a-101. Methods and Technique of Automatic Polishing. H. C. Clements. *Journal of the Electrodepositors Technical Society*, v. 23, 1948, p. 79-90. (Reprint.)

Various types of machines for automatic polishing. (To be presented at Annual Conference, The Society, Birmingham, England, April 15, 1948.)

7a-102. A Review of Metal Polishing. L. Mable. *Journal of the Electrodepositors' Technical Society*, v. 23, 1948, p. 91-94. (Reprint.)

(Presented at annual conference. The Society, Birmingham, England, April 15, 1948.)

7a-103. Metal Spraying and Industrial Economy. H. W. Greenwood. *Engineers' Digest* (American Edition), v. 5, April-March 1948, p. 102.

A condensation. Previously published in *Metallurgia*, v. 37, Dec. 1947, p. 60.

7a-104. Metal Surface Protection by Tin Diffusion. *Engineers' Digest* (American Edition), v. 5, March-April 1948, p. 155-156. Translated and abstracted from *Metalloberflache*, v. 1, Aug. 1947, p. 185-187.

Procedure developed and results obtained. It can be applied to copper, copper alloys, and steel. Investigations in German shipyards have proved the good corrosion resistance of the protective layer and its applicability to high-pressure work.

7a-105. Stainless Steel Paint Offers Corrosion Resistance, Hardness and Attractive Surface. George Black. *Materials & Methods*, v. 27, April 1948, p. 86-87.

Use of stainless steel in flake or paste form under corrosive conditions and as a finish for products which must withstand constant exposure.

7a-106. Decals: A Finishing Touch. Alphonse Bihr. *Die Castings*, v. 6, May 1948, p. 65-68.

Decorative, advertising, and identification use on die castings. Types of decals, methods of application, costs, and other factors.

7a-107. Evaluating the Ideal Industrial Instrument Finish. A. H. Kevser. *Product Engineering*, v. 19, May 1948, p. 134-137.

Characteristics required, tests for abrasion resistance, shear hardness, adhesion, appearance, humidity, and results of water immersion. Effect of gloss, drying cycle, and color on the selection.

7a-108. Flame Spraying of Dust Extraction and Ventilation Plant. H. W. Greenwood. *Sheet Metal Industries*, v. 25, April 1948, p. 975-976.

Flame spraying of metals or plastics to provide coatings for ventilating-system ductwork.

7a-109. Surface Preparation: Preparation of Metals for Organic Finishing. Walter R. Meyer. *Organic Finishing*, v. 9, April 1948, p. 12-17.

Methods of cleaning; scale and oxide removal; surface-preparational processes; and specific treatments for steel, aluminum, magnesium, zinc and copper, and brass.

7a-110. Phosphate Treatments for Metals. Walter A. Raymond. *Organic Finishing*, v. 9, April 1948, p. 19, 21-25.

Methods and applications.

7a-111. Surface Preparation as a Measure of Preventing Corrosion. E. Davenport. *Organic Finishing*, v. 9, April 1948, p. 25-27.

Mechanical and chemical methods.

7a-112. Selecting the Right Abrasive Wheel for Portable Power Tools. Van Cunningham. *Organic Finishing*, v. 9, April 1948, p. 27-29.

Recommendations.

7a-113. The Principles of Solvent Vapor Degreasing. G. W. Walter. *Organic Finishing*, v. 9, April 1948, p. 29-37.

7a-114. Finishing Materials; Properties of Synthetic Coatings. F. L. Scott. *Organic Finishing*, v. 9, April 1948, p. 39, 41, 43-47.

7a-115. Electrostatic Spraying Process. Emery P. Miller. *Organic Finishing*, v. 9, April 1948, p. 136-139, 142.

Practical features.

7a-116. Infrared for Finishing. *Organic Finishing*, v. 9, April 1948, p. 150-154.

Advantages, applications, costs, methods, equipment.

7a-117. Organic Coatings for Corrosion Protection; A General Discussion. G. W. Seagren. *Corrosion*, v. 4, May 1948, p. 219-226.

(Presented at Symposium on Modern Metal Protection, Cleveland, Sept. 27, 1947.)

7a-118. Stripping of Copper. Part IV. The Sodium Polysulphide Sodium Cyanide Method. F. C. Mathers and E. L. Martin. *Plating*, v. 35, May 1948, p. 463-464.

Report published in the Sept. 1946 issue of *Monthly Review*, covered the use of calcium polysulphide and sodium cyanide for stripping of copper. This report covers the extension of this work to include the use of sodium polysulphide and its application to Zn-base die castings.

7a-119. Polythene and Plating. *Electroplating*, v. 1, May 1948, p. 302-308, 346.

A "plastic" material. Its use in lining of plating and pickling vats and in the coating of those portions of racks and jigs which are not to receive an electrodeposit.

7b—Ferrous

7b-74. The Production of Flexible Zinc Coatings. Heinz Bablik. *Corrosion and Material Protection*, v. 5, March-April 1948, p. 8-9.

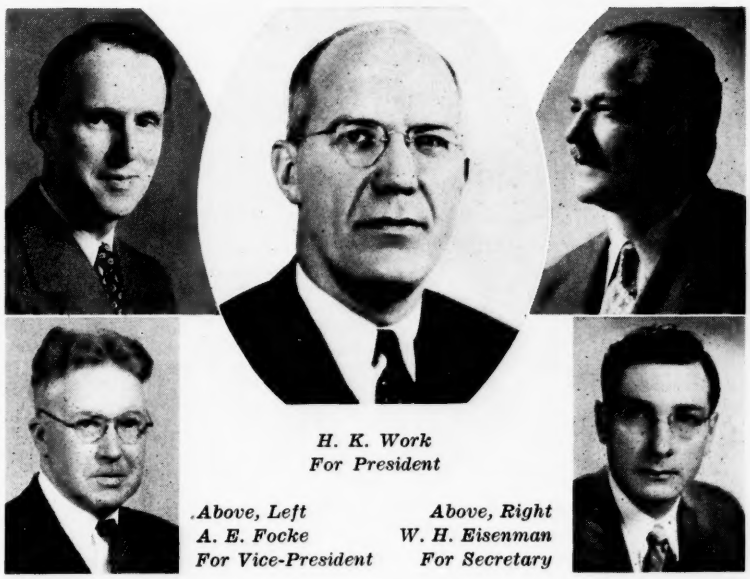
Adhesive strength of coating to base and deformation of the coating in a hot-dip galvanizing process.

7b-75. Determination of Compressive Stress Present in Porcelain Enamel on Sheet Iron. E. E. Bryant and M. G. Ammon. *Enamelist*, v. 25, April 1948, p. 10-15.

Method consists of preparation of

(Turn to page 24)

New National Officers Nominated by A.S.M.



H. K. Work
For President

Above, Left
A. E. Focke
For Vice-President

Above, Right
W. H. Eisenman
For Secretary

H. P. Croft ←——— *Trustees* ———→ *F. J. Robbins*

Harold K. Work, who has been nominated for president of the American Society for Metals, is manager of research and development of the Jones & Laughlin Steel Corp., Pittsburgh. Dr. Work joined J. & L. in 1936, following four years as a research fellow at Mellon Institute and seven years with Aluminum Co. of America in the research laboratories. He received his A.B. and Ch.E. from Columbia, and his Ph.D. from University of Pittsburgh.

Arthur E. Focke, who will be the new vice-president, is research metallurgist for Diamond Chain and Mfg. Co., Indianapolis. Dr. Focke is a graduate of Ohio State University, where he received his master's and doctor's degrees in 1926 and 1928 respectively. He has been with Diamond Chain since 1930, following employment by General Electric Co., and P. R. Mallory Co.

Frederick J. Robbins, nominated as one of two new trustees, is vice-president and metallurgical engineer for Plomb Tool Co., and also president of Sierra Drawn Steel Corp. Before coming to Los Angeles, he was metallurgical engineer and field service engineer for Bliss & Laughlin, Inc., Harvey, Ill.

The second new trustee is Harry P. Croft, director of technical control and research, midwestern district of Chase Brass and Copper Co. A 1921 Rensselaer graduate, Dr. Croft has been with Chase Brass since 1923—with some time on the side in 1938 and 1942 to garner M.S. and Ph.D. degrees from Case, and again for military service in 1942-45, when he progressed from major to colonel as chief of the industrial division of the Cleveland Ordnance District.

W. H. Eisenman, whose name comes up for renomination by a special committee every two years, will begin his 31st year as secretary of the American Society for Metals next fall. Those readers who don't already know all about him are referred to the October 1947 issue of *Metal Progress*, page 556.

The Reviewing Stand

JUST A FEW statistics about Volume 4 of the Review of Metal Literature (the bound volume containing the installments published in *Metals Review* during 1947), now coming off the press.

Number of annotations—8299 in 1947 as against 5502 in 1946—an increase of 50%.

Number of periodicals surveyed—375 against 293.

Number of foreign language publications—42 as against 18.

Number of books reviewed—281 as against 185.

Number of entries in the subject index—15,000 against 8000.

All of this adds up to an overwhelming increase in the service during the past year. These figures, however, would be still more imposing if they were given only for the last six months of the year when the largest part of the increase was made. As shown in the tabulation below, the number of annotations printed in *Metals Review* per month took a decided jump last August:

Feb.	539	May	591	Aug.	724	Nov.	807
Mar.	407	June	499	Sept.	806	Dec.	694
Apr.	567	July	597	Oct.	721	Jan.	784

The first two statistics given above are a little puzzling and might lead one to conclude that the number of articles published per journal is on a pronounced upward trend. No engineer, however, would make this assumption without examining all other possible variables, namely: the number of miscellaneous publications abstracted (government reports, preprints, isolated pamphlets that are not included in the list of periodicals), completeness of coverage of individual periodicals, inclusion of individual abstracts for articles published in bound volumes of various society proceedings, transactions, and journals. In other words, even though the list of periodicals surveyed has not increased in proportion to the number of articles abstracted, the technical literature of the world as a whole is getting a much more thorough going-over.

Questions We Can't Answer Department

Since three people were kind enough to write and tell us all about Nobilium, we'll try you out on two more questions. Right down our alley this month (Metal Cleaning and Finishing Issue, in case you've forgotten) should be a request for information about Uebersax, thought to be a metal finishing process connected with barrel tumbling.

Another reader wants to know where he can get stirring rods for use in melting copper alloys that will not contaminate the melt with iron.

Who can help? M.R.H.

laboratory samples under carefully selected and controlled conditions and measurement of warpage produced in the sample due to application of enamel on one side. Compares data obtained with expansion curves.

7b-76. Hot Dip Galvanizing—Why It's the Sound Surface Coating. Robert B. Finn. *Weld*, v. 4, April 1948, p. 10-11.
Procedures and reasons for its soundness.

7b-77. Recommendations for an Enamel Plant Control System. John L. McLaughlin. *Better Enameling*, v. 19, April 1948, p. 6-9, 18.

7b-78. Size Is No Object in the Porcelain Enameling of Parts at McCray Refrigerator Company. *Better Enameling*, v. 19, April 1948, p. 10-13, 24-27.

7b-79. Ingenuity Marks Sanitaryware Manufacturing at Briggs. *Ceramic Industry*, v. 50, April. 1948, p. 82-83.
Covers Porcelain enameling, materials-handling, and inspection.

7b-80. Modern Porcelain Enameling. Part II. G. H. Spencer-Strong and Others. *Ceramic Industry*, v. 50, April 1948, p. 108-109, 111, 114, 117.
Continuous furnaces; spraying arrangements; drying, brushing, and inspection; layout for appliance ware; and cover-coat units. Four plant-layout diagrams. (To be continued.)

7b-81. Electrochemical Cleaning of a Large Steel Casting; an Experiment. John A. Wettergreen. *American Foundryman*, v. 13. April 1948, p. 120-124.
Results of a successful experiment conducted to determine the possibilities of removing fused sand and iron oxides from the interior of a large cast-steel turbine shell by use of an electrolytic molten-caustic bath. Presented at 52nd annual meeting, A.F.A., Philadelphia, May 3-7, 1948. Also published as Preprint No. 48-23.

7b-82. Bonderizing Process Uses Gas for Heating Solutions. *Industrial Gas*, v. 26, April 1948, p. 9, 22-23.
Use on body parts.

7b-83. Detergent Additions Improve Pickling Bath Efficiency. *Iron Age*, v. 161, April 29, 1948, p. 77.
Use of a complex organic sodium sulphonate designed as a wetting and washing agent.

7b-84. A Continuous Furnace Enameling Plant for Commercial Refrigerators. E. B. Flowers. *Finish*, v. 5, May 1948, p. 17-20, 66.

7b-85. Decorative Processes for Porcelain Enamel. H. C. Draker and R. F. Morrison. *Finish*, v. 5, May 1948, p. 31-34, 68, 70, 72.
Various decorative methods including information regarding the colors used in each case.

7b-86. How We Answered the Problem of All-White Gas Range Tops Using Titanium Enamel Over Ground Coat on Titanium Steel. B. A. Gillette. *Finish*, v. 5, May 1948, p. 40-41.
Development of satisfactory procedure.

7b-87. Fixtures Facilitate Automatic Buffing. *Iron Age*, v. 161, May 6, 1948, p. 94.
Buffing of stainless-steel moldings for automobile rear windows and windshields.

7b-88. First Report of the Methods of Testing (Corrosion) Sub-Committee. *Journal of the Iron and Steel Institute*, v. 158, April 1948, p. 463-493.
Work which led to provisional British Standard No. 1391:1947, Performance Test for Protective Schemes Embracing Stoving Paints Used in the Protection of Light Gage Steel and Wrought Iron Against Corrosion. Salt spray test was devised and standardized. Single coats of stoving paints were applied over phosphated or nonphosphated steel on typical industrial finishes. Statistical analysis of the test results.

7b-89. Recent Investigations Into the Hot-Dip Tinning of Steel Spoons and Forks. W. E. Hoare and K. W. Caulfield. *Sheet Metal Industries*, v. 25, April 1948, p. 925-930, 932.
Methods used in Great Britain, U. S., and Germany. Outlines research done on pickling and etching; composition of flux and method of fluxing; temperatures and times of immersion; use of flux and oil covers on the dipping baths; methods of manipulation, particularly for fine-tinning; methods of quenching; and quenching media.

7b-90. Mechanized Porcelain Enameling of Steel Tubs. Fred M. Burt. *Products Finishing*, v. 12, May 1948, p. 14-16, 18, 20, 22, 24, 26.

7b-91. How Tank Capacity Affects Galvanizing Cost. Wallace G. Imhoff. *Products Finishing*, v. 12, May 1948, p. 42, 44, 46, 48, 50, 52, 54.
A thorough discussion.

7b-92. Barrel Finishing of Metal Products. Part 21—The Application of Ceramic Barrels to the Finishing of Metal Products. H. Leroy Beaver. *Products Finishing*, v. 12, May 1948, p. 58, 60, 62, 64, 66, 68.

7b-93. High-Temperature Ceramic Coatings for Steel. *Steel Processing*, v. 34, May 1948, p. 245-247. Condensed from address by W. N. Harrison at Symposium on Modern Metal Protection.
Work done at National Bureau of Standards.

7b-94. Improved Automotive Finishes as Engineering Materials. M. G. Bell and W. W. Bauer. *Organic Finishing*, v. 9, April 1948, p. 48-50, 52-60. **Longer-Life Paints Coat Today's Cars.** (A condensation). *SAE Journal*, v. 56, May 1948, p. 71-72.
Trends over past 10 to 12 years.

7c—Nonferrous

7c-15. Vapor Blasted Grain for Lithographic Plates. E. G. Carlson. *National Lithographer*, v. 55, Feb. 1948, p. 39, 106.
Results obtained with zinc plates.

7c-16. Recherches Preliminaires Effectuees a l'Aide du Radio-Zinc 65. (Preliminary Research Accomplished With the Aid of Radioactive Zinc 65.) Ch. Haenny and P. Mivelaz. *Helvetica Chimica Acta*, v. 31, March 15, 1948, p. 633-642.
Considerable valuable information was obtained concerning the mechanism of surface reactions of zinc, the deposition of Zn and Au or Pt, and the separation of Cu from Zn by electrolysis.

7c-17. Phosphate Treatments for Zinc Surfaces. E. E. Halls. *Metallurgia*, v. 37, April 1948, p. 299-305.
Test results with respect to adhesion over periods up to one year obtained on various forms of zinc to which several different types of phosphate treatment had been applied.

7d—Light Metals

7d-18. Surface Oxide Removal Important in Final Processing of Aluminum. D. E. Durkin. *Materials & Methods*, v. 27, April 1948, p. 82-85.
Operations of cleaning and deoxidation prior to welding or anodizing. Presents data on surface resistance vs. time of exposure, immersion time vs. surface resistance on aging, and optimum treating time at a definite concentration of various solutions.

7d-19. Brunak Controls Oxidation on Aluminum Plates. Michael H. Bruno and Paul J. Hartsuch. *Modern Lithography*, v. 16, April 1948, p. 51, 53.
Modification of "Cromak" surface treatment for Al plates. HF is substituted for H_2SO_4, resulting in much greater protection against oxidation. Recipe for the Brunak solution and directions for its use as well as for platemaking on "Brunaked" aluminum.

7d-20. Process Sheet for Dichromate Treatment of Magnesium, George Black. *American Machinist*, v. 92, May 6, 1948, p. 135.

7d-21. Preparation of Wrought Aluminum for Painting. R. H. Prislin. *Enamelist*, v. 25, April 1948, p. 7-9, 61-62, 64, 67.
Classification charts of aluminum alloy sheet and plate. Physical treatments, solvent precleaning, and chemical cleaning. (To be continued.)

7d-22. Painting Aluminum. A. J. Ward. *Electroplating*, v. 1, May 1948, p. 309-314.
Solvent, chemical and electrolytic methods of cleaning and degreasing and mechanical and chemical methods of etching or slightly roughening the surface prior to painting or enameling.

7d-23. Phosphate Coating of Aluminum and Polymorphism of Chromium Phosphate. G. L. Clark and A. P. Tai. *Science*, v. 107, May 14, 1948, p. 505.
Results of chemical and X-ray-diffraction analysis of a coating obtained by treatment with a chromic acid and phosphate solution. A whole series of aluminum phosphates representing polymorphism, various hydrates, and phosphoric acid forms was found. Additional lines correspond to aluminum oxide and aluminum fluoride, but the chromium phosphate producing the green color is evidently amorphous. Results of an intensive investigation of chromium phosphates in an effort to identify this compound.

For additional annotations indexed in other sections, see:

3d-23; 16b-38; 22a-104; 22b-154; 23d-78; 27a-64.

8
ELECTRODEPOSITION and ELECTROFINISHING

8-107. Electrodeposition of Tungsten Alloys. *Corrosion and Material Protection*, v. 5, March-April 1948, p. 10, 17.
Results of an investigation by the National Bureau of Standards.

8-108. The Brightening Action of Organic Sulphonates in Bright Nickel Plating. G. E. Gardam. *Sheet Metal Industries*, v. 25, April 1948, p. 743-743, 755.
The mechanism of absorption of the sulphonate and of its brightening action. Inclusion of the addition agent was confirmed by the presence of appreciable amounts of carbon and sulphur in the deposit and

(Turn to page 26)

Symposium on Nondestructive Testing Held

Cincinnati Executives and Guest Speakers at Tri-Chapter Meeting—a Symposium on Nondestructive Testing
Photograph by Wm. R. Wasson

Reported by Edward P. Jackson
The Tool Steel Gear & Pinion Co.

Approximately 300 members were present to attend an all-day symposium on nondestructive testing which featured the annual Tri-Chapter Meeting of the American Society for Metals on April 8. Cincinnati Chapter was host to the Columbus and Dayton Chapters for the event, which was opened at 9:00 a.m. with a short welcoming address by W. A. Maddox, chairman of the Cincinnati Chapter. The speakers and their subjects for the morning and afternoon sessions were as follows:

Inspection With Magnaflux, by C. E. Betz, executive vice-president, Magnaflux Corp.

Inspection With Zyglo, by W. E. Thomas, vice-president, Magnaflux Corp.

The Pros and Cons of Radiography, by J. B. Caine, metallurgist, Sawbrook Steel Castings Co.

Interpretations of Radiography, by Wm. Schweikert, Stacey Bros. Gas Construction Co.

Practicability of Supersonic Testing, by R. B. Delano, Sperry Products, Inc.

The G. E. Ultrasonic Materials Tests, by Howard E. VanValkenburg, development engineer, General Electric Co.

The General Electric Metals Comparator, by Donald E. Bovey, development engineer, General Electric Co.

SR-4, the Bonded Wire Resistance Strain Gage, by F. G. Tatnall, manager of testing research, Baldwin Locomotive Works.

Development and Application of the 22 Million Volt Betatron in Industrial Radiography, by Jack T. Wilson, physicist, Allis-Chalmers Mfg. Co.

Following dinner at the Engineering Society of Cincinnati, Reid L. Kenyon, director of research, American Rolling Mill Co., presented a brief summary of all the talks. This was followed by a lively discussion period.

President Visits Montreal

Reported by W. R. Holden
Plant Metallurgist, Canadair Limited

Monday, April 5, was National President's Night at Montreal Chapter A.S.M., and consequently the speaker was Francis B. Foley, superintendent of research for the Midvale Co. Prior to the general meeting an informal cocktail party was arranged for all past chairmen and the executives to meet the guest speaker.

In the absence of the amiable Bill Eisenman, Mr. Foley doubled as coffee speaker, and took the opportunity to present, first hand, matters of national society importance. The topic of his technical lecture was "Heavy Forgings", a subject that has been presented before many A.S.M. chapters during the current season.

Cold Metal Products Opens Office

Cold Metal Products Co., Youngstown, Ohio, producers of cold rolled carbon, alloy, spring and stainless steel strip, has opened a new district office in Indianapolis, Ind. District sales manager in charge of the office is L. B. Warstler.

Furnaces Defined And Classified

Reported by James W. Haupt
Cardwell Mfg. Co., Inc.

The meaning of the term "furnace" as used in industry—and how it differs from an oven, kiln, or induction heating device—was explained by W. F. Ross, sales engineer for the Electric Furnace Co., before the April meeting of the Wichita Chapter A.S.M. He described the batch type and the continuous type of furnace and their methods of use.

Various ways of conveying material through continuous furnaces are by belt, walking beam, roller hearth and shaker hearth. Allowable stresses for conveying rollers at high temperatures range from 3000 psi at 1300° F. to 500 psi. at 2000° F.

Furnaces are also classified as to the method of heating as well as by the atmosphere surrounding the work while it is being heated. Mr. Ross explained the construction of atmosphere-type furnaces and their method of use. Furnaces are further classified by method of heating, which may be electricity or some fuel such as coal, gas or oil. There are still a few coal-fired furnaces in use in this country but most fuel-fired furnaces today burn either gas or oil.

The temperature of furnaces may be controlled either manually or automatically, although automatic controls are much more satisfactory and easily save their cost by more economical operation.

the presence of waxy material after dissolution of the deposits in nitric acid. Three possible mechanisms, evidence in support of adsorption on metallic Ni. The brightening action is ascribed to the smoothing action brought about by inclusion of a greater amount of sulphonate on raised areas. Periodic variations of current density cause the parallel lines typical of bright-Ni deposits.

8-109. Electroformed Precision Prisms. Benjamin Goldberg. *Journal of the Optical Society of America,* v. 38, April 1948, p. 409-412.

Details of an investigation to determine the feasibility of producing electroformed retro-directive copper reflectors with an accuracy approaching that of the precision-ground trihedral glass prism used as the mold. It was found that the metal prism, although about as accurate as the glass prism at a distance of one mile, was still not as accurate as its mold. However, continued improvement in optical accuracy of the successively manufactured prisms indicates that ultimate accuracy possible by electroforming had not yet been determined. Reflectors produced by electro-forming would cost about one sixth as much as commercially produced glass prisms of the same optical accuracy.

8-110. Mechanism of Electrodeposition of Nickel. Part III. Influence of Selenium Dioxide Addition on the Structure and Internal Stress of Nickel Deposits (In Russian.) G. S. Vozdvizhenskii. *Zhurnal Prikladnoi Khimii* (Journal of Applied Chemistry), v. 20, Nov. 1947, p. 1171-1175.

It was found that SeO_2 additions to the electroplating bath, even in very small amounts, affect to a certain extent the structure and appearance of nickel deposits. It is believed that SeO_2 serves as catalyst for saturation of the deposit with hydrogen.

8-111. The "New Look"; The Impact of Nuclear Physics on Electrodeposition Theories. *Metal Industry,* v. 72, April 9, 1948, p. 286-288; April 23, 1948, p. 326-329.

Written in order to stimulate the interests of chemists and engineers in the study of the physical side of the science of electrodeposition, this controversial article gives a picture of the processes involved in electrodeposition when approached from the angle of the physicist.

8-112. Zinc Film Permits Plating on Magnesium. H. K. DeLong *American Machinist,* v. 92, May 6, 1948, p. 98-100.

Development of satisfactory process. Details of procedure for cleaning, pickling, and applying the film. The new process has been used to apply Cr, Ni, Cu, brass, Cu, Zn, Au, and Ag.

8-113. Process Sheet for Indium Plating. George Black. *American Machinist,* v. 92, May 6, 1948, p. 139.

8-114. Plating Techniques for Rebuilding Aircraft Engine Parts. Joseph Albin. *Iron Age,* v. 161, May 6, 1948, p. 82-85.

An installation where laboratory developed procedures and jigs have established standardized, production-type operations and have resulted in substantial savings. Jig designs and process specifications for several types of electrodeposition including the double plating of tin and silver, lead-indium work, silver plating for soft bearing surfaces, press-fit coatings, and plating to build up worn surfaces to dimension.

8-115. Anodes. E. R. Thews. *Metal Finishing,* v. 46, March 1948, p. 68-75; April 1948, p. 61-66; May 1948, p. 74-79.

Previously abstracted from *Metal Industry.* See items 8-134, 8-150, 8-157, 8-173, R.M.L., v. 4, 1947.

8-116. Electrodeposition of Metallic Coatings on Magnesium Alloys. R. R. Rogers and M. L. Boyd. *Sheet Metal Industries,* v. 25, April 1948, p. 959-962.

Result of experimental work dealing with deposition of Zn; deposition of composite metal coating (Ni-Sn-Ni and Zn-Cu-Ni); deposition on Mg alloys containing small percentages of Ag or Pb; and preferred conditions for deposition from fluoborate baths. It was found that Zn can be plated on typical Mg alloys from a fluoborate bath; that Zn-Cu-Ni coatings are less porous than Ni alone; that 1% Ag or Pb in the 1.5%-Mn Mg alloy makes it easier to plate with Zn or Ni; and that certain conditions are common to Zn and Ni plating of Mg alloys. (Presented at 3rd International Conference on Electrodeposition of Electrodepositors' Technical Society.)

8-117. Batch Electropolishing of Small Parts. Ray Vicker. *Steel Processing,* v. 34, May 1948, p. 259-260.

Method developed for small steel parts and results obtained. (Based on paper by J. F. Kreml, presented at Chicago Technical Conference, March 1948.)

8-118. Modern Electroplating Laboratory for Development and Pilot-Plant Studies. George Jernstedt. *Metal Finishing,* v. 46, May 1948, p. 52-56.

Laboratory and facilities.

8-119. Fabricating and Finishing Stainless Steel. Part IV. Arthur P. Schulze. *Metal Finishing,* v. 46, May 1948, p. 64-68, 79.

Electropolishing. Ten chief reasons for using this process and all necessary information, including formulas and detailed operating instructions.

8-120. Electroplating Research; Past and Present. George Dubpernell. *Plating,* v. 35, May 1948, p. 446-448.

A brief historical survey.

8-121. Stress Data on Copper Deposits From Alkaline Baths. A. Kenneth Graham and Robert Lloyd. *Plating,* v. 35, May 1948, p. 449-450, 506.

Experimental results. The procedure was the usual one, the Soderberg-Graham general stress equation being used in the calculations. Effects of variations in operating conditions and bath compositions, including effects of impurities or addition agents.

8-122. Mechanical Properties of Nickel Deposits. E. J. Roehl. *Plating,* v. 35, May 1948, p. 452-455, 478.

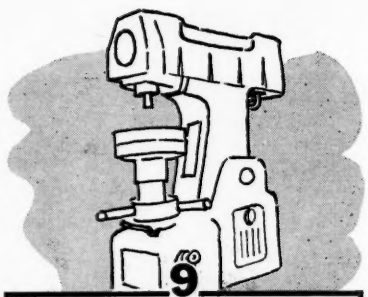
Effects of pH on various mechanical properties are given for as-plated and annealed deposits from Watts baths of several compositions. 13 ref.

8-123. Control of Electroplating Solutions by Analysis and Observation. Part I.—Introduction. K. E. Langford. *Electroplating,* v. 1, May 1948, p. 318-320.

Various aspects of the problem. (To be continued.)

For additional annotations indexed in other sections, see:

3b-10; 7a-118-119; 7c-16; 12a-53; 12b-27; 22a-104; 22d-23.



9 PHYSICAL and MECHANICAL TESTING

9a—General

9a-30. Gage Length Marker for Tensile Test Specimens. *Iron Age,* v. 161, April 29, 1948, p. 93.

Increased accuracy and speed in routine marking of gage lengths on tensile test specimens is said to have resulted from the use of a specially built marker developed by a British firm.

9a-31. Fatigue Testing Heavy Structures. *Iron Age,* v. 161, May 13, 1948, p. 77.

Testing of structures up to 1500 lb. in weight at Douglas Aircraft Co., by means of a heavy-duty vibration table. The procedure is said to be applicable to making vibration tests on washing machines, portable and automobile radio equipment, and other automotive accessories as well as any other piece of moving equipment.

9a-32. Fatigue Testing Heavy Structures. George Sachs. *Iron Age,* v. 161, May 13, 1948, p. 78-83.

Characteristics of strain-aging. Lists 72 references covering some 40 years' study on various aspects of the subject, as well as the various criteria suggested and used for establishing the susceptibility of a steel to strain aging.

9a-33. New Creep Testing Machines. Joseph Marin. *Automotive Industries,* v. 98, May 15, 1948, p. 46-47, 78.

In the past, most creep tests have been made on specimens subjected to simple static tensile stresses. Recently, several static-tension; static-torsion; static-bending; fluctuating-tension; and fluctuating, torsion-tension, creep-testing machines were developed at The Pennsylvania State College.

9b—Ferrous

9b-22. Contribution a la Qualification Mécanique des Fontes Grises et a l'Amélioration de Leur Comportement en Service. (Mechanical Testing of Gray Cast Iron and Improvement of Its Properties for Practical Applications.) Albert Collaud. *Fonderie,* Dec. 1947, p. 949-952; discussion, p. 954-959.

States that classification of gray cast iron should be made on the basis of two separate methods: A simple static test characterizing the strength and toughness and also indicating the distribution of graphite; and a simple dynamic test characterizing tenacity and ductility of the material.

9b-23. Les Essais Mécaniques des Fontes Grises. (Mechanical Testing of Gray Cast Iron.) Jacques Prache. *Fonderie,* Dec. 1947, p. 952-954; discussion, p. 954-959.

(Turn to page 28)

Hardening Theories of Past 50 Years Evaluated by Austin on Sauveur Night

Reported by W. L. Badger
General Electric Co., River Works

Current theories of the hardening of steel were evaluated against the background of the past 50 years by James B. Austin, director of research, U. S. Steel Corp., in the annual Sauveur Lecture of the Boston Chapter A.S.M. on April 2.

In 1896 Professor Sauveur presented before the A.I.M.E. a paper entitled "The Microstructure of Steel and the Current Theories of Hardening" which was universally recognized as a pioneer contribution to metallography and which touched off a debate that continues even today. This paper attempted to decide between the two theories of hardening then popular, namely, the "cement carbon" theory and the "allotropic" theory.

Thirty years later Prof. Sauveur decided to review the subject again and circulated among a group of 29 metallurgists a questionnaire asking their opinion on the nature, structure and mechanism of formation of martensite. The replies to these questions were summarized in a paper before the A.I.M.E. in 1926.

Dr. Austin's commemorative lecture at Boston again reviewed current concepts of the hardening process to learn which controversies described by Sauveur are now settled, which remain and what new questions have been raised.

It is now established that beta iron (that is, nonferromagnetic alpha-iron) is not a significant factor in hardening steel. It is also realized now that it is meaningless to speak of iron carbide molecules dissolved in iron. Carbon is present in atomic form.

The lattice structure of austenite has been determined and it has been shown that carbon occupies positions at the center of the unit cube and at the midpoint of the edges. The lattice structure of martensite has also been worked out, though with less certainty than for austenite.

The mechanism by which the iron lattice in austenite shifts to that in martensite has been proven to be a shear process. The formation of martensite is therefore a diffusionless process as compared to the formation of pearlite, or bainite, by nucleation and growth. The precise cause of the hardness of martensite is still obscure.

The significance of microstructures found in hardened steel has been greatly clarified in recent years, Dr. Austin showed. The idea of the transformation of martensite to troostite, sorbite and pearlite in steps has been abandoned, though the concept of stages has been retained in considering the atomic mechanism of tempering.

The occurrence of cracks in hardened steel results from the presence of stresses arising from thermal gradients or differential volume change and can be minimized by suitable procedures such as martempering.

See Inside Back Cover for Metal Show Hotel Reservations

James B. Austin (Center) Presented a Historical Review of the Theories of Hardening When the Boston Chapter Honored the Memory of Albert Sauveur on April 2. Left is Chapter Chairman Carlton B. Lutts, and Right is Everett L. Reed of Watertown Arsenal, Who Served on the Sauveur Night Committee. (Photo by H. L. Phillips)

Science

Simplified for Steel Works Stenographers*

I assume in the beginning
You are all aware that "twinning"
Has an allotropic form in Neumann Bands,
And the phenomenon of "slip"
In cold distorted strip
Is something everybody understands.

It was controversial, quite,
As to what was martensite
Until Jeffries and Archer took the case;
It is ferrite, they surmised
Finely grained and crystallized
Having body-centered lattices in space.

Now Arnold still insists
That martensite consists
Of a carbide holding ferrite in suspension,
While the needles, Osmond feels,
Seen in martensitic steels
Are pseudomorphs of twinnings due to tension.

Now next I will explain
That each individual grain
Is anisotropic—then I will relate
How this anisotropic grain
In the mass will give again
A pseudo-isotropic aggregate.

If a liquid isn't pure,
When solidified, it's sure
(An eminent professor so insists)
To show some indication
Of dendritic segregation
Since heterogeneity exists.

Dr. Rosenhain proclaims
That on cooling there remains
An amorphous intercrystalline cement,
While distortion of the lattice
Causes hardening, and that is
Because adjacent atoms will be bent.

It is interesting, I think,
That zirconium and zinc
With lattices hexagonal close-packed,
If distorted when they're cold
(By Jeffries we are told)
Are tolerably certain to be cracked;

While iron, he relates
In its alpha and beta states,
Has body-centered lattices, and though
It should be rank futility
To look for good ductility
Yet curiously enough it isn't so.

*Composed in 1926 by L. Gerald Firth, general manager, Firth Sterling Steel Co. After 22 years, the theories put forth are still so applicable that republication seems warranted.—W. L. Badger.

The possibility of application of methods used for steel.

9b-24. Stress-Rupture Characteristics of Various Steels in Steam at 1200° F. J. T. Agnew, G. A. Hawkins, and H. L. Solberg. *Engineering Experiment Station, Purdue University, Research Series* No. 101, May, 1947, 62 pages.

An investigation in which small tensile specimens made from low-carbon; C-Mo; 2¼% Cr-1% Mo; 5% Cr-Mo-Si; 9% Cr-Mo-Si; 12% Cr; 18% Cr-8% Ni; 25% Cr-20% Ni; and 5% Cr-Mo-Ti steels, were placed in a steam reaction chamber at 1200° F. and stressed in tension for periods of time ranging from 10 hours to 7700 hours. Time to rupture, elongation, reduction in area, depth of scale layer, and type and angle of fracture. 33 ref.

9b-25. Production Hardness Testing in a Malleable Shop. C. Schneider and L. Ulsenheimer. *American Foundrymen's Association, Preprint* No. 48-25, 1948, 5 pages.

Two methods for measuring Brinell hardness of pearlitic malleable castings. The first is the method of applying the Brinell load of 3000 kg. through a 10-mm. ball. The diameter of the impression is measured and this value is converted to Brinell hardness number. The second uses a direct-reading machine by applying first a 1500-kg. pre-load, resetting the dial to zero, and then applying a 3000-kg. load. The dial on the machine then indicates the hardness of the casting. Sources of error.

9b-26. Development of Cleavage Fractures in Mild Steels. A. B. Bagsar. *American Society of Mechanical Engineers, Paper* No. 47-A-75 (Advance Copy.), 1947, 43 pages.

Previously abstracted from *Welding Journal*, v. 27, March 1948, p. 97S-123S. See item 9b-13, 1948.

9b-27. A Method of Evaluating Transition From Shear to Cleavage Failure in Ship Plate and Its Correlation With Large-Scale Plate Tests. Noah A. Kahn and Emil A. Imbembo. *Welding Journal*, v. 27, April 1948, p. 169s-182s; discussion, p. 182s-185s, 216s.

The "tear test" described utilizes a notched test specimen 3 x 5 in. x full plate thickness, which is asymmetrically loaded in static tension to complete failure under controlled temperature conditions. The load-extension diagram obtained for each specimen indicates the energy input required to start initial failure and to propagate the fracture to completion. (Presented at 28th Anual Meeting, A.W.S., Chicago, Oct. 19, 1947.)

9b-28. A Study of Slotted Tensile Specimens for Evaluating the Toughness of Structural Steel. H. R. Thomas and D. F. Widenburg. *Welding Journal*, v. 27, April 1948, p. 209s-215s; discussion, p. 215s-216s.

Slotted tensile specimens of rimmed and killed-steel plate were tested to determine the effect of temperature, sharpness of the notch at the ends of the slot, and ratio of the length of the slot to the width of the plate, and the tensile strength and on energy for fracture, and also to determine the transition temperature from shear to cleavage fracture. Results of tests on 6 and 12-in. wide specimens of a rimmed steel and of 12-in.-wide specimens of killed steel. (Presented at 28th Annual Meeting, A.W.S., Chicago, Week of Oct. 19, 1947.)

9d—Light Metals

9d-3. A Fluidity Test for Aluminum Casting Alloys. W. E. Sicha and R. C. Boehm. *American Foundrymen's Association, Preprint* No. 48-34, 1948, 5 pages.

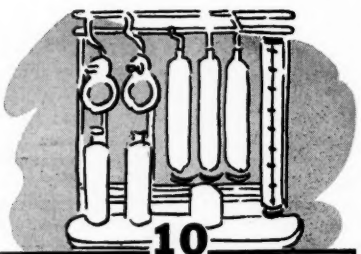
Details of a standardized procedure for measuring relative fluidity or mold-filling capacity of different lots of the same Al alloy.

9d-4. The Development of a Permanent Mold for Aluminum Tensile Test Bars. L. J. Ebert, R. E. Spear, and G. Sachs. *American Foundrymen's Association Preprint* No. 48-13, 1948, 16 pages.

A mold for the above with a short-time operating cycle. The two-bar mold cavity was designed so that sound castings can be obtained with the pouring of a small amount of metal, and with a minimum of trimming. Factors which influence mold operation and test-bar properties were examined by the casting of five different Al alloys.

For additional annotations indexed in other sections, see:

3b-64.



10a—General

10a-34. Les Méthodes Spectrographiques d'Analyses Appliquées au Contrôle des Alliages de Fonderie. (Spectrographic Methods of Analysis Applied to the Control of Alloys in the Foundry.) Paul Croisant. *Fonderie*, Dec. 1947, p. 995-998.

10a-35. The Determination of Oxidized Zinc in Ores and Concentrator Products. C. W. Barker and R. S. Young. *Journal of the Society of Chemical Industry*, v. 67, Feb. 1948, p. 61.

Satisfactory procedure depending on the selective solubility of minerals in a dilute H_2SO_4 solution saturated with SO_2.

10a-36. A Review of Electrolytic Methods of Microchemical Analysis. A. J. Lindsey. *Analyst*, v. 73, Feb. 1948, p. 67-73; discussion, p. 74.

10a-37. Systematic Analysis of Cations by a Polarographic Method. Part I. Conditions for Determination of the Copper and Iron Subgroups. (In Russian.) M. A. Portnov and A. A. Kozlova. *Zhurnal Analiticheskoi Khimii* (Journal of Analytical Chemistry), v. 2, Nov-Dec. 1947, p. 345-352.

A study of the influence of different factors on the reduction potential and the intensity of the polarographic waves of Cu, Bi, Cd, Pb, Fe, Cr, and Al. 21 ref.

10a-38. Constitution of the Phosphate-Vanadate-Molybdate Complex Produced During Colorimetric Determination of Phosphorus by Mission's Method. (In Russian.) N. V. Maksimova and M. T. Kozlovskii. *Zhurnal Analiticheskoi Khimii* (Journal of Analytical Chemistry), v. 2, Nov.-Dec. 1947, p. 353-358.

A formula for the complex compound was established. Possibility of a gravimetric or volumetric determination of P in the presence of large amounts of V by o-hydroxyquinoline percipitation of the complex. 13 ref.

10a-39. Investigation of Slightly Soluble Metavanadates From the Point of View of Their Relative Solubilities. (In Russian.) V. L. Zolotavin. *Zhurnal Analiticheskoi Khimii* (Journal of Analytical Chemistry), v. 2, Nov-Dec. 1947, p. 364-372.

Relative solubilities of a series. Methods for separation of iron ions from vanadate ions in the presence of mercurous salts and for separation of mercurous, iron, silver, and copper ions, in the form of their vanadates, from other cations. The superiority of mercurous vanadate for gravimetric determination of vanadium.

10a-40. Report of Committee E-3 on Chemical Analysis of Metals. *American Society for Testing Materials, Proceedings*, v. 47, 1947, p. 431-434.

10a-41. Die Komplexometrische Titration der Erdalkalien und Einiger Anderer Metalle mit Eriochromschwarz T. ("Complexometric"—Titration of Alkaline-Earth and Several Other Metals Using Eriochrome Black T.) W. Biedermann and G. Schwarzenbach. *Chimia*, v. 2, March 15, 1948, p. 56-59.

Potentiometric titration method for determination of Mg, Ca, Sr, Zn, Cd, Pb, Mn, and Hg, using "Eriochrome Black T" as an indicator.

10a-42. Ford's Lab-On-Wheels Makes Analyses on the Spot. *SAE Journal*, v. 56. April 1948, p. 59-62. Based on "The Control of Materials by a Motorized Laboratory", by Henry A. Tuttle and George A. Nahstoll.

Mobile laboratory that travels to various parts of the 1200-acre Rouge plant to make chemical and physical tests of metals in storage of scrap, and of work in process.

10a-43. Bibliography of Publications Dealing With the Polarographic Method in 1946. (In English.) J. Heyrovsky and O. H. Muller. *Collection of Czechoslovak Chemical Communications*, v. 12, Nov.-Dec. 1947, p. 677-685.

141 references.

10a-44. Komplexone. VII. Titration von Metallen mit Nitrilotriessigsäure, H_3X. Endpunktsindikation durch pH-Effekte. VIII. Titration von Metallen mit Urammildiessigsäure, H_2Z. Endpunktsindikation durch pH-Effekte. IX. Titration von Metallen mit Athylendiamin-tetraessigsäure, H_4Y. Endpunktsidikation durch pH-Effekte. (Complex Compounds. Part VII. Titration of Metallic Ions Using Triacetic Acid Nitrile, H_3X. Indication of End-Point by pH Effect. Part VIII. Titration of Metallic Ions Using Uranyldiacetic Acid, H_2Z. Indication of End-Point by pH Effect. Part IX. Titration of Metallic Ions Using Ethylenediamine Tetraacetic Acid, H_4Y. Indication of End-Point by pH Effect.) G. Schwarzenbach and W. Biedermann. *Helvetica Chimica Acta*, v. 31, March 15, 1948, p. 331-340, 456-465.

Results using above methods for determination of a long series of metallic ions. Nature of the complex ions formed.

10a-45. Take Guesswork Out of Metal Identification. George Black. *Products Finishing*, v. 12, May 1948, p. 30, 32, 34, 36, 38.

Simplified methods for distinguishing aluminum from magnesium, bare from clad aluminum sheet, and corrosion resistant from carbon steel.

10a-46. Determination of Impurities in Electroplating Solutions. VII. Traces of Cadmium in Nickel Plating Baths. Earl J. Serfass, W. S. Levine, G. Frederick Smith and Frederick Duke. *Plating*, v. 35, May 1948, p. 458-462.

(Turn to page 30)

Control of Blast, Uniformity of Operation Essential in Shot-Peening

Reported by John E. McClure
Buick Motor Division

Shot-peening is a means of cold working a metal by applying a rain of shot to the surface of a part, thereby setting up compressive stresses on the surface to a depth of several thousandths of an inch. This was the definition given by John C. Straub, chief research engineer of the American Wheelabrator and Equipment Corp., who spoke on "Shot-Peening to Increase Fatigue Strength" at the April meeting of the Saginaw Valley Chapter A. S. M.

These compressive stresses, he continued, resist tension and torsion stresses which occur during the operation of the part, with an amazing increase in fatigue life. It is essential that critical areas of a part be as nearly finished as possible prior to shot-peening.

Equipment for shot-peening is essentially the same type as used in abrasive cleaning. It includes a projecting device such as a Wheelabrator or a nozzle, a separator for removing broken shot, a shot-adding device, dust collector, a cabinet and a conveyor.

Control of the blast is a vital factor in shot-peening. It is inspected by using the Almen test strip and Almen gage which shows the arc height of the strip after peening. The intensity depends on the speed, size and hardness of the individual shot pellets, and effect of the blast is further dependent on the angle of impact and time of exposure.

Economical conditions for increased fatigue life usually require 80 to 100% coverage of the part. When coverage is increased from 80 to 100%, the added increase in life is only on the order of 10%, which is out of proportion to the difference in cost.

A decrease in fatigue life by overpeening has been found only on very thin sections at excessive intensities. Uniformity is essential and can only be obtained by having a stabilized machine which removes broken shot at the same rate at which it breaks; at least 85% whole shot must be maintained.

Shot breakdown increases almost as the cube of its speed, and speed must, therefore, be kept close to the minimum. Broken shot should be removed, since it does not increase fatigue life beyond that obtained by the whole shot and merely wears down equipment. Broken shot can be used for abrasive cleaning.

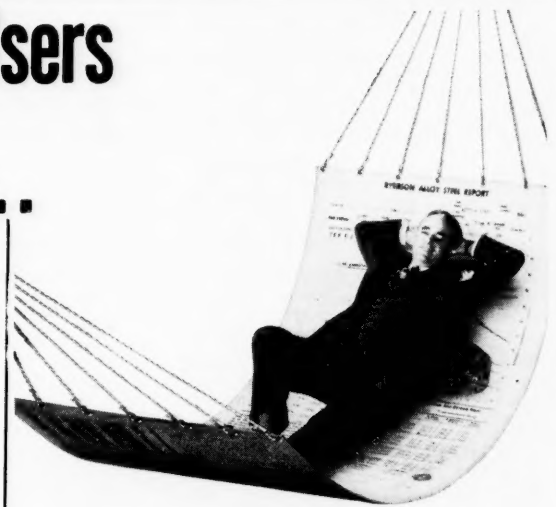
Uniformity of shot hardness is essential, since variation will have the same effect as using broken shot. At a given arc height, angle of impact does not materially affect the life of the part, provided it is uniform.

Although the effect of variation in speed of shot has not been tested, Mr. Straub has not seen a single exception to the fact that uniformity of shot size, hardness and angle of impact will give the optimum fatigue life at a minimum cost.

Shot-peening, he said, can pay its own way. Many times a reduction in the size of part can be accomplished.

F. P. Zimmerli, chief engineer of Barnes - Gibson - Raymond, led the meeting as technical chairman. During the discussion which followed Mr. Straub's talk, he pointed out that arc height should be used only to control the equipment on production operations; an increase in arc height does not imply that increased fatigue life will be obtained.

Alloy Users Relax...



...on Ryerson Chart Service

When you buy alloy steel from Ryerson stocks you can relax in the knowledge that your steel will accurately meet performance requirements. That's because you can specify the minimum hardenability you need and, with Ryerson tested alloys plus chart service, be sure you get it.

This safe, convenient service begins with the hardenability testing of all annealed and as-rolled Ryerson alloys. You specify hardenability and Ryerson selects only those bars that meet your requirements on the basis of actual tests—minimizing the possibility of failure in finished parts.

Then, you receive a Ryerson Alloy Report with the steel that charts the test results and lists chemical analysis, mechanical properties and recommended working temperatures. The Report not only confirms the steel's hardenability but also serves as a useful heat treating guide.

Hardenability is nothing new with Ryerson. It's been part of Ryerson Alloy Service for ten years now—part of a system designed to help you buy and assure the correct application of all alloy steel. So for extra service on alloys draw on the nation's largest stocks, ready for prompt shipment from nearby Ryerson plants. A new Ryerson Alloy Stock List is available on request.

Joseph T. Ryerson & Son, Inc., Plants: New York, Boston, Philadelphia, Detroit, Cincinnati, Cleveland, Pittsburgh, Buffalo, Chicago, Milwaukee, St. Louis, Los Angeles, San Francisco.

RYERSON STEEL

Following a literature survey which proved fruitless, the authors developed a satisfactory procedure which is described in detail. After removal of Cu and Fe and separation of Cd from Ni, the Cd is determined colorimetrically.

10b—Ferrous

10b-26. An Investigation of the Use of Geiger-Muller Photo-Electron Counters in the Spectrographic Analysis of Phosphorus in Steel. Richard Hanau and Ralph A. Wolfe. *Journal of the Optical Society of America,* v. 38, April 1948, p. 377-383.

Construction of the counters and methods of electrically shielding and mounting them on the Littrow spectrograph. The adjustments of counter orientation, slit widths, and focus with reference to the analyses of ferrous alloys where good resolution is necessary. Because of absorption of radiation by quartz at low-wave-lengths, both absolute and relative intensities are dependent upon the position of the arc on the electrode surface. This effect, which results in appreciable error was investigated photographically and with G-M counters. 20 ref.

10b-27. The Cenco-Derge Rapid Oxygen Determination. J. H. Richards. *Proceedings, National Open Hearth Committee, Iron and Steel Division, American Institute of Mining and Metallurgical Engineers,* v. 30, 1947, p. 160-164; discussion, p. 164-168.

Use of the Cenco-Derge vacuum-fusion equipment is said to be one of the first attempts to use a measured rather than a calculated value for the oxygen content of liquid steel as a basis of deoxidation control. Results of a study of variations in rejections associated with inconsistent deoxidation, using both tap carbon and tap oxygen as criteria.

10b-28. A Rapid Spectrographic Control Method for Determination of Lime-Silica Ratios in Openhearth Slags. J. F. Woodruff. *Proceedings, National Open Hearth Committee, Iron and Steel Division, American Institute of Mining and Metallurgical Engineers,* v. 30, 1947, p. 179-184; discussion, p. 184-186.

Development of a satisfactory method.

10b-29. A Direct Reading Spectrometer for Ferrous Analysis. Stanley H. Walters. *Proceedings, National Open Hearth Committee, Iron and Steel Division, American Institute of Mining and Metallurgical Engineers,* v. 30, 1947, p. 281-287; discussion, p. 287-289.

10b-30. Detecting Residual Elements in Steel by Spectrographic Analysis. Hubert Swett. *Steel,* v. 122, May 3, 1948, p. 106, 109, 128, 130.

New installation at San Francisco plant of Bethlehem Pacific Coast Steel Corp.

10b-31. A Discussion on Routine Chemical Methods for the Analysis of Niobium and Tantalum Bearing 18-8 Steels. B. Rogers. *Metallurgia,* v. 37, April 1948, p. 326-330.

Essential chemical principles involved in determination of Cb, Ta, and W in steel; T. R. Cunningham's procedure and its application to the analysis of these steels when 0 to 0.6% W is present with Mo in varying amounts, and up to 0.1% Ti is present; analysis when the amount of tungsten is greater; and determination of the additional alloying elements Co, Cu, Sn, and Se. 42 ref.

10c—Nonferrous

10c-31. The Photometric Determination of Tungsten. C. H. R. Gentry and L. G. Sherrington. *Analyst,* v. 73, Feb. 1948, p. 57-67.

A precise procedure based upon reduction in HCl solution by tin amalgam and subsequent addition of thiocyanate. Conditions of acidity required for complete reduction, effect of thiocyanate concentration, conditions for stabilizing the reduced state, and optimum conditions of final acidity were systematically investigated. Interferences from diverse cations and anions, and instructions for the application of the method to typical steel and nonferrous metal analyses. 14 ref.

10c-32. The Determination of Oxide Lead in Ores and Concentrator Products. R. S. Young, A. Golledge, and H. L. Talbot. *Mining Technology,* v. 12, March 1948, T.P. 2303, 4 pages.

Method which overcomes the disadvantage of existing procedures wherein lead phosphates and vanadates are counted as sulphides. It consists in leaching first with ammonium acetate solution to dissolve sulphate, carbonate, and oxide, and extracting the residue with dilute perchloric acid. Lead phosphate and vanadates are soluble in the latter reagent, while lead sulphide is only attacked to a very slight degree.

10c-33. Polarographic Determination of Zinc in Metallic Cadmium After Preliminary Electrodeposition From Hydrochloric Acid Solution. (In Russian.) P. N. Kovalenko. *Zhurnal Analiticheskoi Khimii* (Journal of Analytical Chemistry), v. 2, Nov.-Dec. 1947, p. 334-340.

Preliminary separation of metallic Al and electrolysis using Al electrodes from HCl solutions at 200° C. After solution of metallic Cd is accomplished, most of it is deposited on a spiral of Al wire, and the remainder electrolyzed. After separation of Cd, the Zn is determined polarographically.

10c-34. The Color Reaction of Zinc With Methylviolet (Rhodanide). (In Russian.) V. I. Kuznetsov. *Zhurnal Analiticheskoi Khimii* (Journal of Analytical Chemistry), v. 2, Nov.-Dec. 1947, p. 373-376.

Effects of various factors on qualitative identification test.

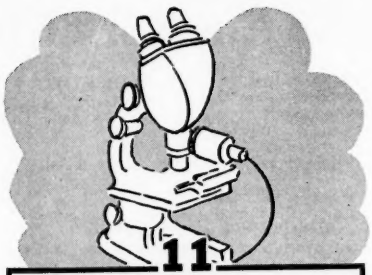
10c-35. Colorimetric Microdetermination of Zirconium. David E. Green. *Analytical Chemistry,* v. 20, April 1948, p. 370-372.

Comprises development of an accurate method for clays or silicate rocks, using the pink lake formed by zirconium-alizarin-sulphonate complex. Method applies to a range of zirconium oxide content up to 0.275 mg. with an accuracy to 0.003 mg. of zirconium oxide. 10 ref.

10c-36. Inorganic Spot Test for Copper. Frieda Goldschmidt and Binyamin R. Dishon. *Analytical Chemistry,* v. 20, April 1948, p. 373-374.

Appearance of a violet color when concentrated hydrobromic acid reacts with salts of divalent Cu is basis of test which requires only common inorganic reagents and has a sensitivity comparable to tests with organic reagents.

A practical presentation of heat treatment theory
PRINCIPLES OF HEAT TREATMENT
by M. A. Grossmann
244 pages—$3.50
American Society for Metals
7301 Euclid Ave. Cleveland 3, Ohio



11
APPARATUS, INSTRUMENTS and METHODS

11-90. Microradiography of Gray Cast Iron. E. I. Salkovitz, J. H. Schaum, and F. W. Von Batchelder. *Transactions of the American Foundrymen's Association,* v. 55, 1947, p. 82-88; discussion, p. 88.

A technique by which graphite in gray cast iron may be studied with conventional X-ray equipment. Good results are obtained by using an industrial type, tungsten-target, X-ray tube. The effects of different exposure times, photographic plates, and radiation. Photo-micrographs and microradiographs of the same specimens are included to permit comparison of the graphite as observed by the two different methods.

11-91. Instrumentation in Openhearth Practice. J. Talfryn Davies. *Iron and Steel Institute Special Report* No. 39, "Reports of the Affiliated Local Societies", Dec. 1947, p. 28-36.

Need for instrumentation in the iron and steel industry, particularly in connection with openhearth furnaces. Various systems for use on the gas producer and the furnace itself. (Presented at a meeting of Swansea and District Metallurgical Society, Swansea, England, Jan. 19, 1946.)

11-92. New Method for Determination of the Thickness of Naturally Passive Films on Metals. (In Russian.) I. V. Krotov and T. M. Khachadurova. *Izvestiya Akademii Nauk SSSR, Otdelenie Khimicheskikh Nauk* (Bulletin of the Academy of Sciences of the U.S.S.R., Section of Chemical Sciences), Jan.-Feb. 1948, p. 50-56.

A simple method using a stylus weighted with lead collars of varying weights. The relationship of depth of abrasion to load for films on aluminum is shown graphically. The curve has two sections: one corresponding to deformation of the film without rupture, and one to rupture. A graphical and mathematical method for determining film thickness from the deformation section of the curve.

11-93. Metal Optics at Centimeter Wave-Lengths—Part I. L. Speirs. *Philosophical Magazine,* 7th Series, v. 39, Feb. 1948, p. 105-116.

The optical properties of metals in the form of thin films. Two methods were used to investigate the surface resistance of metal films at a wave-length of 1.25 cm. In one the guided wave is allowed to traverse the film and its support once; reflection and transmission coefficients are found by direct measurement of the reflected and transmitted waves. The second method consists in loading a cylindrical-cavity resonator with the film supported on a flat disk of "low-loss" material, and noting the resonance

(Turn to page 32)

Metallurgical Aspects of Electroplating Include Grain Orientation, Stress, Physicals

Reported by Robert T. Hook
Assistant Metallurgist, Warner & Swasey Co.

Some metallurgical aspects of electroplating were described by Leland Morse of the Chrysler Corp. in a lecture before the Cleveland Chapter A.S.M. on April 5. Mr. Morse discussed the metallography and physical properties of electrodeposits and showed how these characteristics may affect service life. The material for the lecture was prepared jointly by Carl E. Heussner, chief materials engineer at Chrysler, Alvin R. Balden, head of the electroplating laboratory, and Mr. Morse, who is in charge of electrofinishing processes.

The majority of electrodeposits are columnar (or some variation of this structure), even though the grain is too fine to resolve microscopically. Since the columnar grains are oriented perpendicular to the base metal, electrodeposits show directional variations in tensile strength, elongation and hardness. In general, finer grained deposits of a given metal show higher tensile strength and hardness and lower elongation.

Most metals as electrodeposited have internal stress, Mr. Morse pointed out. Nickel, iron and chromium deposits are usually in tension, but the use of certain addition agents will greatly reduce the stress or make it negative.

Laboratory methods for measuring ductility, tensile strength, hardness, and stress were described and data were presented on numerous nickel and copper deposits. A shop method was suggested for checking plate ductility, which is sensitive enough to show variations in condition of a bath that are not detectable visually.

Stress alone may have some bearing on the corrosion life of a coating, but poor ductility is usually serious, and poor ductility coupled with stress is intolerable. The factors of adhesion and porosity have an important bearing on the useful life of a coating.

The application of science to electroplating is receiving great impetus and important improvements in the properties of coatings and their life are being made which will widen the scope of this method of finishing.

For the coffee talk George B. Saviers, communication sales engineer for Westinghouse Electric Corp., demonstrated the function of radar and showed a movie of a radar-equipped ore freighter, the William G. Mather, on a trip from Lake Superior to Cleveland.

See Inside Back Cover for Metal Show Hotel Reservations

Adds Metallurgy Department

A department of metallurgy will be established at Stevens Institute of Technology on July 1, and will take over work in the metallurgical field now being carried by the department of chemistry. It will occupy a new building, the William H. Peirce Memorial Laboratory of Metallurgy, which is now nearing completion.

Alfred Bornemann, now associate professor of chemistry, who becomes professor of metallurgy, will head the department, with a staff of six.

Compliments

To CARY H. STEVENSON, vice-president of Lindberg Engineering Co. Chicago, on his election as president of the Industrial Furnace Manufacturers Association.

♦ ♦ ♦

To CHARLES L. HEATER, vice-president and director of American Steel Foundries, Chicago, on the award of the Technical and Operating Medal of the Steel Founders' Society of America, "for his contributions to the technical and operating work of the society".

♦ ♦ ♦

To EDGAR D. FLINTERMAN, president of Michigan Steel Casting Co., Detroit, on the award of the Lorenz Medal of the Steel Founders' Society of America "for his contributions to the society and the progress of the steel castings industry".

♦ ♦ ♦

To P. D. ANTIA, development officer for metal industries, Ministry of Industry & Supply, Government of India, on his appointment as honorary secretary to the Indian Institute of Metals.

Metallographers!

Don't Forget—
3rd Annual
Metallographic Exhibit

to be held in conjunction with the National Metal Exposition in Philadelphia next October. Details and rules for entries of exhibits will be published soon.

HARSHAW ANODES and CHEMICALS

OUR job for more than fifty years has been to concentrate on improving the quality of the anodes and chemicals used by platers. You can depend on Harshaw products to keep your production moving.

NICKEL PLATING . . . nickel anodes—all commercial grades and sizes . . . anode bags . . . nickel salts—single and double . . . nickel chloride . . . nickel carbonate . . . boric acid.

CHROMIUM PLATING . . . pure "Krome Flake" 99.8% CrO_3 . . . sulphates less than .10% . . . lead, tin-lead and antimony-lead anodes.

COPPER PLATING . . . copper ball anodes . . . Rochelle Salts . . . sodium and copper cyanides . . . copper sulfate . . . copper fluoborate.

CADMIUM PLATING . . . ball and cast cadmium anodes . . . cadmium oxide . . . sodium cyanide.

TIN PLATING . . . cast tin anodes . . . sodium stannate . . . stannous sulfate . . . tin fluoborate . . . acid tin addition agent.

ZINC PLATING . . . ball and cast zinc anodes . . . sodium and zinc cyanide . . . zinc sulfate.

LEAD PLATING . . . cast lead anodes . . . lead fluoborate.

SILVER PLATING . . . silver cyanide . . . silver nitrate.

THE HARSHAW CHEMICAL CO.
1945 East 97th Street, Cleveland 6, Ohio
BRANCHES IN PRINCIPAL CITIES

frequency before and after its insertion.

11-94. A New Experimental Electron Microscope. G. Liebmann. *Journal of Scientific Instruments and of Physics in Industry,* v. 25, Feb. 1948, p. 37-43.

Instrument deviates in many ways from known types. It employs four permanently aligned magnetic lenses and optical magnification. A new type of specimen stage, permitting a quick exchange of specimen, wide-angle stereoscopic observations, direct calibration of specimen position, and an improved electron gun are used. It can be quickly adapted for electron-diffraction observations. Possibilities of further development.

11-95. Polarographic Study of Corrosion Phenomena. Pierre Van Rysselberghe, John M. McGee, Armin H. Gropp, Robert D. Williams and Paul Delahay. *Corrosion and Material Protection,* v. 5, March-April 1948, p. 11-16.

Use of polarograph, experimental technique, and analysis and interpretation of polarograms.

11-96. Phase Microscopy With Vertical Illumination. Helen Jupnik, Harold Osterberg, and G. E. Pride. *Journal of the Optical Society of America,* v. 38, April 1948, p. 338-342.

Adaptation of phase microscopy for observing specularly reflecting specimens with the vertical illuminator. The method can be used advantageously to examine those surface irregularities which give rise to small differences in optical path or in phase between the reflected-ray bundles. Both bright and dark contrast with excellent definition may be obtained by use of suitable diffraction plates.

11-97. Mold Dryness Measured by New Device. R. E. Hadady. *Foundry,* v. 76, May 1948, p. 322, 324, 326.

Instrument known as the "Electric Hygro-Cel" which responds in less than one second to either decreasing or increasing moisture in the surrounding air.

11-98. The Value of Pressure Tests and Radiographs of Gun Metal Castings. W. H. Baer. *American Foundrymen's Association, Preprint No.* 48-43, 1948, 7 pages.

Correlates X-ray findings with hydrostatic pressure tests, at 250 psi. for 15 min., of gun metal cast plates of various thicknesses.

11-99. Apparatus for Measuring Young's Modulus and Decrement of Graphite and Metals. John W. Michener and J. S. Handloser. *U. S. Atomic Energy Commission,* MDDC-1428, Nov. 5 1947, 12 pages.

Instrument is essentially an impedance bridge for measuring the a. c. resistance between two electrodes of a quartz crystal which are part of a composite oscillator. The oscillator is a quartz bar, to which is glued a specimen of the material under test.

11-100. Use of New Mechanical Equipment. *Proceedings, National Open Hearth Committee, Iron and Steel Division, American Institute of Mining and Metallurgical Engineers,* v. 30, 1947, p. 108-112.

An illustrated survey by C. R. FonDersmith of some new types of equipment for speeding up furnace repair and maintenance.

11-101. Tungsten Wire Straightener. A. A. Jarrett. *U. S. Atomic Energy Commission,* MDDC-1646, Feb. 3, 1945, 2 pages.

Device which aids in straightening 5 to 9 mil. diameter wire.

11-102. Apparatus for the Rapid Taking of Magnetization Curves. K. P. Belov and G. M. Strakhovskij. *Engineers' Digest* (American Edition), v. 5, March-April 1948, p. 103-105. Translated and condensed from *Zavodskaya Laboratoriya,* no. 6, 1946, p. 577-582.

Details of method using a cathode-ray oscilloscope. Circuit diagrams, fundamentals of the method, and typical results.

11-103. The Detection, Separation and Microtitration of Iridium. W. B. Pollard. *Bulletin of the Institution of Mining and Metallurgy,* April 1948, p. 9-18.

Methods for Au, Pt, and Pd used in the assay of ores and concentrates and for control of refinery operations. Reports indicate that with Cu-Ni ores it is possible to make an assay for these metals on a 100 to 300 g. sample. With concentrates, a reduction to about 1/40 in the amount of assay sample is possible. 15 ref.

11-104. An Oxide Replica Technique for the Electron Microscope Examination of Stainless Steel and High Nickel Alloys. E. M. Mahla and N. A. Nielsen. *Journal of Applied Physics,* v. 19, April 1948, p. 378-382.

The oxide film is produced on the metal surface by oxidation in a molten nitrate solution and is chemically stripped from the base metal by a bromine-methanol solution. Replicas of this type were used to study deep-etched structures, preferential etch attack, and secondary phases in austenitic and ferritic stainless steel and in nickel.

11-105. Preferred Orientation Determination Using a Geiger Counter X-Ray Diffraction Goniometer. B. F. Decker, E. T. Asp, and D. Harker. *Journal of Applied Physics,* v. 19, April 1948, p. 388-392.

Use of a simple and accurate method of determining pole figures for absorption change and change in diffracting volume as the sample changes position with respect to the X-ray beam. Results for cold-rolled copper.

11-106. Simultaneous Measurement of Tensional and Electrical Resistance of Fine Wires. J. T. Norton and G. C. Kuczynski. *Instruments,* v. 21, April 1948, p. 328.

Application to strain-gage material to determine gage factors and fatigue characteristics.

11-107. A Fifty-Point Bridge Balance Unit for Use With a Baldwin SR-4 Strain Indicator. N. C. Fick and N. A. Crites. *Instruments,* v. 21, April 1948, p. 329-330.

Device designed and built at Battelle Memorial Institute to make a complete stress analysis of a structure under progressive loading.

11-108. Simplified Dynamic Strain Equipment. Will J. Worley. *Instruments,* v. 21, April 1948, p. 330-332.

Method of adapting a commercial strain indicator (Baldwin-Southwark portable unit) to repeated dynamic strain measurements.

11-109. Recent Advances in Electron Microscopy in the United Kingdom. V. E. Cosslett. *Research,* v. 1, April 1948, p. 293-304.

Applications to study of particle size and shape, metallurgical work and biological research; techniques and electron-microscope developments.

11-110. Applications of the Angle Dekkor. B. P. Harrold. *Machinery* (London), v. 72, April 8, 1948, p. 458-460.

Applications of device for checking angles described in March 25 issue.

11-111. Electronic Comparators. *Machinery Lloyd* (Overseas Edition), v. 20, April 10, 1948, p. 104-110.

Use in inspection procedures.

11-112. Vacuum Furnace Control. Frank F. Davis. *Electronics,* v. 21, May 1948, p. 81.

An electronic control which will safeguard tungsten heaters against burnout due to excessive gas pressure.

11-113. Rototrol in Steelmaking. *Westinghouse Engineer,* v. 8, May 1948, p. 73-74.

Equipment for control of a variety of steel-mill equipment. It is essentially a small d.c. generator. Its application to blooming mills and pickling lines.

11-114. X-Ray Thickness Gage for Hot Strip Rolling Mills. C. W. Clapp and R. V. Pohl. *Electrical Engineering,* v. 67, May 1948, p. 441-444.

Condensed from "An X-Ray Thickness Gage for Hot-Strip Rolling Mills", to be published in *A.I.E.E. Transactions,* v. 67, 1948.

11-115. An Indentation Method for Measuring Wear. *Machine and Tool Blue Book,* v. 44, May 1948, p. 141-144, 148, 150, 152.

Use of McKee wear gage, developed at Bureau of Standards. As little as one hundred thousandth of an inch is measured under favorable conditions.

11-116. Small, Simple Machine Tests Gears and Lubricants. *Automotive Industries,* v. 98, May 1, 1948, p. 46, 58.

Machine for bench testing.

11-117. Calibration of X-Ray Measurement of Strain. John A. Bennett and Herbert C. Vacher. *Journal of Research of the National Bureau of Standards,* v. 40, April 1948, p. 285-293.

Method and results obtained in an investigation on the elastic and plastic deformation of metals.

11-118. Magnetic Measurement of the Thickness of Composite Copper and Nickel Coatings on Steel. Abner Brenner and Eugenia Kellogg. *Journal of Research of the National Bureau of Standards,* v. 40, April 1948, p. 295-299.

Previously abstracted from *Plating,* v. 35, March 1948, p. 242-246. See item 8-52, 1948.

11-119. Electronic and Servo Electronic Controls and Their Application to the Iron and Steel Industry. W. G. Thompson. *Journal of the Iron and Steel Institute,* v. 158, April 1948, p. 497-509.

An extensive survey. 19 ref.

11-120. Self-Absorption of Spectrum Lines. R. D. Cowan and G. H. Dieke. *Reviews of Modern Physics,* v. 20, April 1948, p. 418-455.

A study of the mechanism of self-absorption and its effects on the intensities and line shapes of spectrum lines. It was found that a relatively simple model is quite adequate to explain the observed facts in such important cases as arcs and sparks, and that refinements in the theory change the results only in relatively minor details. 56 ref.

11-121. The Determination of Pore Size Distribution From Gas Adsorption Data. C. G. Shull. *Journal of the American Chemical Society,* v. 70, April 1948, p. 1405-1410.

The theory of the interpretation of gas adsorption data in terms of capillary condensation as advanced by Wheeler. It is suggested that the empirical use of experimental adsorption data for materials of large crystal size is preferable to the employment of the BET theory at higher relative pressures (0.35 to 0.99) in evaluating the multilayer thickness of the adsorbed layers. A simplified procedure for applying the theory of capillary condensation to experimental data, thereby obtaining the pore-size distribution.

11-122. Systematic Etching Tests Iden-

(Turn to page 34)

Grinding Symposium Features Wheel Selection, Fluids, Crush Dressing, Centerless Grinding

Reported by A. B. Lyman
Arter Grinding Machine Co.

A joint symposium on grinding, sponsored on the evening of March 10 by the Worcester Chapters of the A.S.M. and the American Society of Tool Engineers, was preceded in the afternoon by a plant visit to the Arter Grinding Machine Co., where the latest developments in rotary and cylindrical grinding machines were inspected.

The first of four speakers on the symposium was H. W. Wagner, research engineer, Norton Co., on "Wheel Selection". Several approaches may be taken to this problem, Mr. Wagner said, and recommendations are quite varied; although selection may appear complicated, reasoning can be used to simplify it.

Three basic types of wheel abrasives are aluminum oxide, silicon carbide and diamond. Grinding may be likened to a contest between the wheel and the work, the work having defense characteristics of hardness, ductility, and ability to erode (or dull) abrasive points. In order to grind, the wheel must penetrate into the work, overcoming its hardness. Ductility in the work resists removal of chips and has a tendency to load the wheel, which is an impediment to wheel action.

"Combative erosion" of abrasive points is a new term; it applies to the wearing off of the abrasive molecules with resulting dull wheel action. The weapons of offense of the wheel are hardness, resistance to erosion, the ability to stay sharp, and lubrication from the bond.

The next speaker, Orum R. Kerst of E. F. Houghton & Co., speaking on "Grinding Fluids", stated that there is a wide diversity of opinion in the industry on this subject. Some companies use one type with excellent results, while others, doing similar work, use a different type with equally satisfactory results.

The first straight oils used in grinding were ordinary shop lubricating oils. These were found lacking in film strength and oils were developed giving this desired quality. Later, sulphurized oils came on the market and the newest development is what is known as the extreme-pressure treated oils. Laboratory tests have shown that the use of additives has increased film strength up to ten times.

Soluble oils, said Mr. Kerst, must have the qualities of emulsion stability, rust prevention, rapid wetting out, and prevention of wheel gumming. The emulsifying agents are the ingredients which make the oil expensive. Rust prevention also hinges on the emulsifying agents, which must not separate out in use. Freedom from gumming of the wheel likewise has to be tied in with stability of the fluid. During the past five years considerable advancement has been made in rapid wetting-out qualities and antiseptic properties.

George Lyman, superintendent of the Reed Rolled Thread Die Co., followed with a talk on "Crush Dressing". Mr. Lyman's company uses crush form dressing to a considerable extent in producing dies for rolling threads and a great variety of special contours. By crushing multiple threads into the wheel, considerable time is saved in producing the dies. Both cylindrical and surface grinding wheels are successfully crush dressed.

The amount of pressure to use in crush dressing, length of time to keep the roll in contact with the wheel, and proper wheel speed are important factors. Crush dressing has reduced grinding time by as much as two-thirds on many multiple-thread jobs.

Hardened high speed steel is used for the crusher roll and as high as 50 crushings can be made before the crusher roll has to be reground. The wheels must fit the wheel mounts tightly, be in good balance, and the mounts must be properly fitted to the spindle noses. Once a wheel is dressed to its form, it is left mounted for quick set-up.

The final speaker on the program was George F. Langley, tool engineer at Baldwin-Duckworth Div., Chain Belt Co., who spoke on "Internal Centerless Grinding". This type of grinding has been used at Baldwin-Duckworth since 1936 with excellent results, but it is important that quantities be large, that the o.d. and i.d. be concentric, and that the o.d. be round and straight.

After the machine is once set up, the cycle is entirely automatic. The table is reciprocated at a high rate of speed. Gaging is automatic. As the hole approaches the finish size, the machine travel slows down, the wheel is automatically dressed, the hole finished to size, and the piece discharged, another piece being loaded. When the wheel wears beyond a certain diameter, the machine is automatically shut down until a new wheel is mounted. Workpieces must be of uniform length for gaging.

The advantage of this method of grinding is that one operator is able to take care of five or six machines. Holes can be ground in square or hexagonal pieces using what is known as the shuttle.

Tulsa Executives Meet With Dr. Focke

Arthur E. Focke, A.S.M. National Trustee, Was the Principal Speaker at National Officers Night of the Tulsa Chapter. The photograph shows members of the local executive committee at a premeeting conference with Dr. Focke. Standing, left to right, are: Lauren G. Kilmer of Stanolind Oil and Gas Co.; Charles W. Gay of McAlear Mfg. Co.; and Leslie E. Bates, Jr. of Walter O'Bannon Co. Seated are: E. H. McQuiddy of Walter O'Bannon Co.; Ernest M. Newland of Oklahoma Steel Castings Co.; Dr. Focke; and Dale L. Hall of Oklahoma Steel Castings Co., chapter chairman. (Reported by Leslie E. Bates)

tify Nonmetallic Inclusions in Steel. H. V. Kinsey. *Canadian Metals and Metallurgical Industries,* v. 11, April 1948, p. 14-16.

The type of results to be expected from use of a systematic series of etching tests to positively identify nonmetallic inclusions in steel.

11-123. Vinyl-Metal Combination. *Modern Plastics,* v. 25, May 1948, p. 166.

Commercially produced material which can be used for sealing porous casings or seams in metal work. It is made by combining a metallic powder and a specially prepared vinyl compound.

11-124. Phase Diagrams and the Phase Rule. William L. Fink. *Metal Progress,* v. 53, May 1948, p. 672-675.

Auxiliary experimental problems and a simplified derivation of the phase rule. Concluding portion of "Determination of Phase Diagrams."

11-125. Air-Driven Spinners. L. W. Wightman. *Machine Design,* v. 20, May 1948, p. 121-125.

Devices designed for testing fast-rotating machine components up to bursting speeds posed difficult design problems.

11-126. Low-Torque Potentiometers Simplify Many Control Problems. H. D. Wright. *Machine Design,* v. 20, May 1948, p. 134-136.

Design and applications of typical types of low-torque potentiometers, such as one mounted on the face of a dial-micrometer gage for control or remote indication of thickness.

11-127. Measurement of Thickness of Oxide Coatings on Aluminum Alloys. Ralph B. Mason and William C. Cochran. *Metal Finishing,* v. 46, May 1948, p. 69-73.

Previously abstracted from *A.S.T.M. Bulletin,* Oct. 1947, p. 47-51. See item 11-200, R.M.L., v. 4, 1947.

11-128. Quantitative Methods of Studying Aeolotropy in Steel Sheet and Strip. N. F. Astbury and A. E. D. Barr. *Sheet Metal Industries,* v. 25, May 1948, p. 911-916, 921.

Refers to phenomenon usually known as anisotropy. How it can be studied by the use of information derived from measurements of Young's modulus and how in certain cases estimates can be made of the actual degree of crystal orientation present. Estimates can also be made of the principal moduli of single crystals. Experimental technique and details of calculations involved in analysis of the data.

Precision
OPTICAL AND MEASURING INSTRUMENTS
A survey of our products sent on request
THE GAERTNER SCIENTIFIC CORPORATION
1229 Wrightwood Ave., Chicago 14, U.S.A.

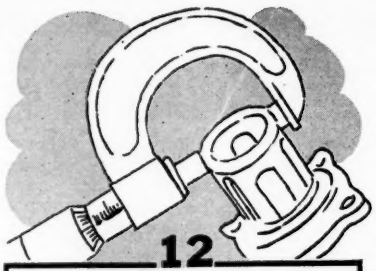
A new approach to the science of metallography by an outstanding expert

METALLOGRAPHIC
TECHNIQUE FOR STEEL

by J. R. Vilella

85 pages—$2.00

American Society for Metals
7301 Euclid Ave. Cleveland 3, Ohio



12 INSPECTION and STANDARDIZATION

12a—General

12a-48. Thickness Gaged by X-Ray. W. N. Lundahl. *Enamelist,* v. 25, April 1948, p. 32-35, 38.

Previously abstracted from *Electrical Engineering,* v. 67, April 1948, p. 349-353. See item 12a-47, 1948.

12a-49. Gaging of Precision Screw Threads. A. C. Pruliere. *Microtecnic,* v. 2, Feb. 1948, p. 33-41. (Translated from the French).

Gives data on profiles of Whitworth, Sellers, D.I.N., and S.I. threads. Mechanical, optical, and electrical methods. (To be continued)

12a-50. Statistical Quality Control for the Shop Man. C. W. Kennedy. *Tool & Die Journal,* v. 14, May 1948, p. 52-57.

Recommended methods, including calculation, are described in detail. (Condensed from lecture before New York City Section, American Society for Quality Control, Nov. 21, 1947.)

12a-51. Shop-Run Tolerances. Part I. L. M. Nielsen. *Product Engineering,* v. 19, May 1948, p. 142-144.

Advantages of standards and how they are established. Tolerance tables for iron castings, blanked and pierced parts, and parts bent on dies and bending machines.

12a-52. Radiographic "Relief" Printing. A. J. Weston. *Metal Industry,* v. 72, April 30, 1948, p. 344.

Photographic technique for soldered articles which shows defects clearly even to those unaccustomed to interpreting radiographs.

12a-53. Specifications for Electroplated Metals. *Metal Finishing,* v. 46, May 1948, p. 85.

A.S.T.M., A.M.S., Army-Navy, and Navy Dept. specifications for Cd, Zn, Ni, Ni + Cr, hard Cr, Sn, Pb, Pb-In, and Ag plates.

12a-54. New Detector for Weld Flaws. *Production Engineering & Management,* v. 21, May 1948, p. 55.

Supersonic reflectoscope.

12a-55. Quality Control Increases Overall Efficiency. C. W. Mihle. *Production Engineering & Management,* v. 21, May 1948, p. 69-71.

How salvage has been reduced and product output increased.

12a-56. Gage Control and Measuring Techniques. Philip G. Fishback. *Tool Engineer,* v. 20, May 1948, p. 25-30.

Use in manufacture of camera mechanisms.

12b—Ferrous

12b-26. Nondestructive Testing of Steel Castings; Report of the Steel Division Committee of A.F.A. *Transactions of the American Foundrymen's Association,* v. 55, 1947, p. 574.

New developments between April 1946 and April 1947. Annotated bibliography consisting of 12 items.

12b-27. The Specification and Testing of Cast Iron. Arthur B. Everest. *Foundry Trade Journal,* v. 84, April 1, 1948, p. 317-321.

How British Standards specifications for cast iron are formulated. (Presented to London Branch, Institute of British Foundrymen.)

12b-28. Tentative Industrial Radiographic Standards for Steel Castings. A.S.T.M. Designation: E 71-47 T; Issued 1947. *Foundry,* v. 76, May 1948, p. 199-200.

12b-29. A Survey of Patents, Publications on Nondestructive Tests; Fourth Progress Report on Nondestructive Testing of Drill Pipe. L. R. Jackson, H. M. Banta, R. C. McMaster and T. P. Nordin. *Drilling Contractor,* v. 4, April 15, 1948, p. 64-75.

Significant features of nondestructive test methods described in more than 200 patents and about 200 technical articles. The patented methods are classified by the nature of the energy field established in the test object, or by the method of measurement. The principle of operation of each method, novel features and applications of the significant patents. Several hundred references.

12b-30. Tubular-Goods Testing Device Gives Good Field Results; Used on Stanolind's Deep Oklahoma Producer. Leigh S. McCaslin, Jr. *Oil and Gas Journal,* v. 47, May 6, 1948, p. 83-84.

Results of field tests on the Sclerograph which operates on magnetic and ultrasonic principles. It will determine the tensile strength of tubular goods and also locate slag intrusions, laminations, and holes.

12b-31. Continuous Noncontact Gaging of Hot Strip. *Iron Age,* v. 161, May 6, 1948, p. 78.

Use of X-ray thickness gage as described at recent A.I.E.E. meeting by C. W. Clapp and R. V. Pohl.

12b-32. Naval Radiographical Laboratory to Assist Welding and Casting Technique. A. Wilson. *Metallurgia,* v. 37, April 1948, p. 305-306.

British Navy's laboratory facilities.

12b-33. Iron and Steel Specifications in Russia. *Metallurgia,* v. 37, April 1948, p. 319-320.

American methods seem to have been largely adopted in Russia, according to recently published Russian technical literature. Specifications indicate that Mn in steel compositions is used more than in England or in the U. S. whereas Mo and Co are used less. Significance of the various symbols used to designate compositions of steels and cast irons in Russia. This information is invaluable for those attempting to use the Russian metallurgical literature.

12b-34. Magnetic Particle Inspection of Silver-Plated or Phenolic Resin Coated Steel. V. H. McBride. *Metal Progress,* v. 53, May 1948, p. 691-692.

It was found that 0.0015-in. plate thickness is the maximum at which all discontinuities are indicated using the wet continuous method, and 0.001-in. using the wet residual method. Smooth phenolic coatings also cause an unstable pattern of the magnetic particles, requiring inspection prior to their application.

12b-35. Tentative Hardenability Bands, 1320H to 4132H. *Metal Progress,* v. 53, May 1948, p. 696B.

First of a series of data sheets covering new tentative S.A.E. and A.I.S.I. specifications.

(Turn to page 36)

New Nickel-Chromiun Steel Developed for High Temperatures

Reported by C. T. Haller
Metallurgist, International Nickel Co.

New corrosion and heat resistant metals and the equipment in use at the Rustless Iron and Steel Division for testing high-temperature alloys were described by A. L. Feild, associate director, research division, Armco Steel Corp., on April 8 before the members of the Pittsburgh Chapter A.S.M.

Among the furnaces illustrated was one that can measure the stress-rupture values for 12 specimens at the same time. A rotary furnace tests scaling characteristics of a number of samples over identical heating cycles.

During the war, we used of necessity what was available for parts for turbo superchargers and jet engines, but it is now incumbent upon research staffs in peacetime to develop the most economical combination of alloys that will do the job, Mr. Feild pointed out. In this connection an alloy has been developed, known as GT45, having approximately the following analysis: C, 0.08%; Cr, 16.75%; Ni, 14%; Mo, 2.75%; Cu, 3%; Ti, 0.25%; and Cb, 0.35%.

The recommended treatment for this material is a solution heat treatment at 2250° F. followed by aging at 1250° F. Research is continuing on the effects which cold work will have on this alloy.

These materials with good high-temperature strength have not only wartime applications but also tremendous peacetime possibilities. Such items as tubing for petroleum cracking and for carrying superheated steam are constantly requiring superior alloys.

The discussion was ably led by Russell Franks of the Electro Metallurgical Co. The audience left the auditorium with an appreciation of the tremendous amount of work which must be done at elevated temperatures in order to solve the problem of developing a material that will operate at 1200, 1300, and 1500° F. as efficiently as the standard S.A.E. engineering alloys operate at room temperature. Using columbium, molybdenum, chromium, titanium, and tungsten (and probably other elements) as precipitation agents, efforts are continually being made to develop an alloy that will be stable and will resist deformation over long times under moderately high loads.

Leo Mulholland, Organizer Of Local Chapter, Dies

Leo F. Mulholland, engineer of tests at American Locomotive Co., where he had been employed since 1907, died April 20 as the result of a stroke suffered on Feb. 19.

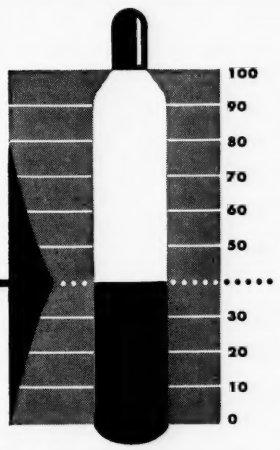
Mr. Mulholland was organizer and first chairman of the Steel Treaters' Society of Schenectady, which became the Schenectady Chapter of the American Society for Steel Treating in 1920 (now the Eastern New York Chapter of the American Society for Metals). He was a past president of the Scotia (N. Y.) Chamber of Commerce, and had long been active in community affairs.

Promoted by Wickwire Spencer

R. R. Tatnall has been appointed field service metallurgist in charge of customer relations for the Colorado Fuel and Iron Corp., Wickwire Spencer Steel Division, Buffalo, N. Y. He has been connected with the company's Morgan plant at Worcester, Mass., for 20 years, currently serving there as quality control manager.

Mr. Tatnall served the Worcester Chapter A. S.M. as chairman in 1934-35. He is also a member of the Wire Association and was awarded an honorable mention by that organization for his paper on "Fatigue Properties of Springs".

Compare the costs of DISSOCIATED AMMONIA and HYDROGEN



For many metal treating applications, dissociated ammonia can reduce your hydrogen costs as much as 60% because: (1) the cost of dissociated ammonia is considerably less than hydrogen per thousand cubic feet of gas . . . (2) one cylinder of ammonia when dissociated supplies as much gas as approximately 34 cylinders of hydrogen, thus greatly reducing cylinder handling and storage problems. You'll find, too, that the low moisture content of dissociated ammonia (Dew Point -60°F.) results in brighter work. The lower pressure of the anhydrous ammonia in the cylinder simplifies control.

The coupon below will enable Armour's Technical Service Department to help you estimate the savings possible for your plant — to advise you on details of ammonia dissociating equipment and installation.

ARMOUR *Ammonia* DIVISION
Armour and Company
1355 West 31st Street • Chicago 9, Illinois
120 Broadway, New York, N. Y.

Mail this coupon today!

Please send me details on dissociated ammonia as a source of hydrogen.

Name_____Title_____
Firm_____
Address_____
City_____Zone_____State_____
Average Wkly. H_2 Req._____CF
Max. Hrly. H_2 Req._____CF

12c—Nonferrous

12c-6. Nominal Chemical Compositions of Standard Copper Alloys. *Materials & Methods,* v. 27, April 1948, p. 107.

Data contributed by Non-Ferrous Ingot Institute.

12c-7. Production Data Sheet: Comparison Chart of Cemented Carbide Grades. *Production Engineering & Management,* v. 21, May 1948, p. 73.

12d—Light Metals

12d-5. Current Light-Alloy Specifications; Corrected to February, 1948. *Light Metals,* v. 11, April 1948, p. 216-224.

British specifications. Includes compositions.

12d-6. Production Hardness Testing Speeds Manufacture of Aluminum Extrusion and Tube Products. Owen Lee Mitchell. *Steel,* v. 122, May 3, 1948, p. 104, 126.

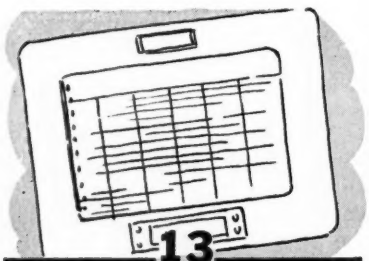
Webster Model B hardness testers are used.

12d-7. Quality Control of Aluminum Sheet. Amiel Gelb. *Iron Age,* v. 161, May 13, 1948, p. 72-77.

Application of hardness testing for quality control of aluminum sheet has made possible significant savings in cost of routine inspection. The Brinell hardness test was found unsuitable for this purpose, but the Rockwell test proved satisfactory. Data are presented for conversion from one Rockwell scale to another and for correlating tensile strength with hardness.

For additional annotations indexed in other sections, see:

7b-79; 11-111; 14a-71; 14b-48; 18b-73; 19b-64.



13 TEMPERATURE MEASUREMENT and CONTROL

13-22. Bath Temperature Measurements. *Proceedings, National Open Hearth Committee, Iron and Steel Division, American Institute of Mining and Metallurgical Engineers,* v. 30, 1947, p. 252-254.

Experiences with different methods and apparatus.

13-23. Temperature Scale of the Blowing-Tube Bath Pyrometer. L. O. Sordahl and J. W. Bain. *Proceedings, National Open Hearth Committee, Iron and Steel Division, American Institute of Mining and Metallurgical Engineers,* v. 30, 1947, p. 255-260.

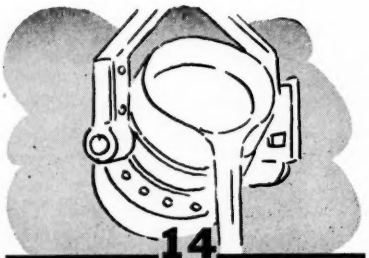
Methods used and results obtained in determination of deviations from the true temperature scale, using a quick-immersion thermocouple method. First, comparative radiation and optical pyrometer readings were made. On calibration of the blowing-tube pyrometer against the quick-immersion thermocouple good agreement was obtained at 2600° F.; but linear divergence occurred with increasing temperatures up to a 66° variation at 3000° F. Effect of substituting nitrogen for oxygen for purging the tube was determined, and it was found that the substitution resulted in practical elimination of the error above 2600° F.

13-24. A Comparison of the Pt-PtRh Thermocouple With the Optical Pyrometer for Temperature Measurements in Liquid Steel. G. R. Fitterer and J. W. Linehart. *Proceedings, National Open Hearth Committee, Iron and Steel Division, American Institute of Mining and Metallurgical Engineers,* v. 30, 1947, p. 289-297.

Simultaneous comparative tests were obtained with each instrument on seven plain-carbon heats of acid openhearth steel. The tests were taken at two periods of the heats. Comparison of simultaneous temperatures showed consistently higher temperatures of 35 to 50° F. for the optical pyrometer. Emissivities were recalculated and found to vary between 0.428 and 0.495 instead of the 0.40 usually assumed. The relation of emissivity to other factors is tabulated in an attempt to determine the reason for the variations. It is shown that optical-pyrometer spoon temperatures are relative to true temperatures, if properly taken and may be correlated with practical metallurgical data.

13-25. Inspection of Pressure Vessels and Tanks. A. P. Maradudin. *Western Metals,* v. 6, April 1948, p. 23-26.

Use of magnaflux and Zyglo for welded vessels.



14 FOUNDRY PRACTICE

14a—General

14a-61. La Mecanisation et la Modernisation des Fonderies. (Mechanization and Modernization of Foundries.) Rene Norquet. *Fonderie,* Dec. 1947, p. 913-922.

Results of a comparative study of foundry practices in France, Great Britain, and the U. S. before and after World War II. Lack of mechanization and modernization in the French industry. Remedies for this situation.

14a-62. Les Moyens Mécaniques de Manutention dans les Fonderies. (Mechanical Means of Control in Foundries.) Rene Kenner. *Fonderie,* Dec. 1947, p. 923-924.

Long-run economy in spite of high initial costs.

14a-63. La Sablerie Dans la Mécanisation des Fonderies. (The Mold-Production Department in the Mechanization of Foundries.) Henri Perchat. *Fonderie,* Dec. 1947, p. 925-927.

Need for standardization and reduction in the number of mold designs in order to achieve efficient mechanization.

14a-64. Le Decochage. (Stripping). Pierre Rigaut. *Fonderie,* Dec. 1947, p. 928-930.

Methods of stripping in foundry practice. Use of mechanical stripping.

14a-65. Récents Progres dans la Technique de Décapage. (Recent Progress in the Technique of Scouring.) G. Cros. *Fonderie,* Dec. 1947, p. 930-932.

Modern mechanical means for cleaning castings.

14a-66. Représentation d'Une Distribution Granulométrique. (Graphic Representation of Grain.) Paul Dauxois. *Fonderie,* Dec. 1947, p. 939-941.

Use of cumulative curves which permit determination of certain coefficients for foundry sand.

14a-67. Dispositifs Spéciaux du Trousseau a Excentrique Permettant le Moulage de Pieces Circulaires Composées de Plusieurs Fragments Usinés a Leur Assemblage. (Special Eccentric Device for Casting of Circular Pieces Composed of Several Sections Machined During Their Final Assembly.) Joseph Pascal. *Fonderie,* Dec. 1947, p. 944-946.

Device is in commercial operation.

14a-68. From a Sandman's Notebook. Harold E. Henderson. *Western Machinery and Steel World,* v. 39, April 1948, p. 98-99.

Foundry sand problems.

14a-69. Chemically Bonded Sand; Its Present Status; Its Future. T. Barlow. *Iron Age,* v. 161, April 22, 1948, p. 80-83.

Originally introduced into commercial use slightly more than a year ago, above sand is now being used in 12 large mechanized foundries producing some 2000 tons of castings daily. Experiences to date and plans for extending its use to steel, bronze, and brass molding and corerooms, as well as smaller shops.

14a-70. Expansion of Silica Sand. Herbert H. Fairfield. *Foundry,* v. 76, May 1948, p. 128-129.

It is pointed out that the greatest stress in the mold face exists in the silica-sand layer at 1100° F., at which point expansion coefficient is greatest. Methods for overcoming casting defects caused by cracking or spalling of the mold face by addition of other materials to the sand, by proper selection of sands and clays, and by softer ramming.

14a-71. Statistical Quality Control; A New Tool for the Foundryman. H. H. Johnson and G. A. Fisher. *American Foundrymen's Association, Preprint No.* 48-7, 1948, 13 pages.

Principles underlying the methods and examples of their application in evaluating process control in a steel foundry.

14a-72. Heat Transfer; A.F.A. Committee Report. H. A. Schwartz. *American Foundrymen's Association, Preprint No.* 48-17, 1948, 16 pages.

Chairman's introduction, two papers on thermal conductivity of sand mixtures, and one each on solidification of Al, white-iron castings and steel spheres, respectively. Each of the papers is being abstracted separately.

14a-73. Thermal Conductivity of a Sand Mixture. C. F. Lucks, O. L. Linebrink and K. L. Johnson. *American Foundrymen's Association, Preprint No.* 48-17, p. 1-3.

Results of a determination for a mixture consisting of 60% 20-30 sand (Ottawa Silica Co.) and 40% No. 7 sand (American Graded Sand Co.) over a range of 750 to 2250° F.

14a-74. Thermal Conductivity of Dry Sands. J. C. Bell. *American Foundrymen's Association, Preprint No.* 48-17, 1948, p. 3-4.

An appendix to the previous paper. (see above abstract.) A theoretical treatment of the problem. The

(Turn to page 38)

Interview on Aluminum Trends Broadcast

As Part of the General Publicity Program of the Rochester Chapter A.S.M., Speakers at the Monthly Meetings Have Been Interviewed Over the Air. Here we see Robert Trebor (left), WVET staff announcer, interviewing Kent R. Van Horn of the Aluminum Co. of America, prior to his address at the April meeting on "Industrial Application of Aluminum"

Reported by Robert S. Guinan
Camera Works, Eastman Kodak Co.

Current trends in aluminum applications were surveyed by Kent R. Van Horn before the Rochester Chapter A. S. M. on April 12. Developing his talk from a consideration of the commercially pure product and its applications, Dr. Van Horn unfolded a clear and concise picture of the successively higher alloyed, higher tensile materials now available, as well as those in the experimental stages. The relative strengths of these alloys, their specific applications, and their available forms were further explained by a series of slides.

Dr. Van Horn also brought to his listeners' attention the specific effects of the "primary alloying elements—namely, magnesium and silicon—and then superimposed the effects of the so-called "secondary" elements—chromium, lead, bismuth, iron and tin—when added to the aluminum melt.

Latest developments in the aluminum field, Dr. Van Horn indicated, would seem to foresee tensile strengths of 90,000 psi. in the not too distant future. Aluminum-tin bearing alloys are one of the more promising new applications for the light metal.

More Than 500 Register For Shopman's Lectures On Working of Steel

Reported by Robert S. Morrow
Chairman, Educational Committee Worcester Chapter A.S.M.

A course of three practical lectures on the working of steel was presented during March by the Worcester Chapter primarily for the men in the shop.

It had been the feeling for many years of a number of Worcester Chapter members that most of the talks and written publications have been of too technical a nature for the practical man to apply to his every-day problems in the working of steel, and that the chapter was definitely failing in not giving such needed service to its sustaining members. The soundness of this conviction is borne out by the unprecedented success of the course, with a total registration of 532.

The three lectures were written by Chester M. Inman, consulting metallurgical engineer. They were printed and bound in a single booklet for distribution to those attending the course. The subjects and the lecturers were as follows:

March 17—Development of a Mental Picture of the Mechanical Structures Inside of Steel, presented by Thomas C. King, metallurgist, New England Metallurgical Corp.

March 24 — Important Physical Characteristics of Steel and Their Practical Application, presented by H. J. Elmendorf, division metallurgist, American Steel & Wire Co.

March 31—The Mechanical Problems of Machinability for Finish and Tool Life, presented by William P. Coomey, general superintendent, Rice Barton Corp.

Metallographers!

Don't forget—

3rd Annual Metallographic Exhibit

to be held in conjunction with the National Metal Exposition in Philadelphia next October. Details and rules for entries of exhibits will be published soon.

new inhibitor for bright pickling

• Now available for the first time is a new type of liquid pickling inhibitor – ENTHONE INHIBITOR 9. This new product completely inhibits most non-oxidizing acids – sulphuric, hydrochloric, hydrofluoric and phosphoric. Scale is beautifully and completely removed from steel wire, sheets, rods and finished work, leaving them clean and bright.

Inhibitor 9 is clean and has no odor. It dissolves easily, stops fuming, lowers surface tension for better wetting and displacement of oil films. It is free-rinsing and saves acid by 20% less drag-out plus 99% less attack on steel. *It has every feature required for a perfect inhibitor.*

Would you like a sample to prove these claims for yourself? If so, write today.

METAL FINISHING CHEMICALS
442 Elm Street • New Haven, Conn.

theoretical and experimental values show reasonably good agreement.

14a-75. Changes in Chemistry of Liquid Steel in Contact With Sand. J. B. Caine. *American Foundrymen's Association, Preprint No.* 48-29, 1948, 3 pages.

Results of a study. This year's report is concerned with changes in chemical composition of steel when it comes in contact with the sand.

14a-76. A Theoretical Approach to the Problem of Dimensioning Risers. J. B. Caine. *American Foundrymen's Association, Preprint No.* 48-36, 1948, 8 pages; discussion, p. 7-8.

The approach is based on heat evolved, heat dissipated, and volume contraction on solidification. The author believes that its use will result in an appreciable increase in casting yields.

14a-77. A Suggested Method for the Determination of Coke Reactivity to Carbon Dioxide at Combustion Temperatures. H. Edward Flanders. *American Foundrymen's Association, Preprint No.* 48-37, 1948, 6 pages.

In an effort to determine the fundamental differences between good and bad cokes, a method for determining the rate of reaction of coke with CO_2 at temperatures existing in cupola combustion is proposed. It is based on analysis of combustion gases during adiabatic combustion of a column of coke. From the relation of composition to height of the coke column, rate of the reaction can be approximately calculated and the coke reactivity with CO estimated as a function of temperature.

14a-78. Surface Gas Pressure of Molding Sands and Cores. H. W. Dietert, H. H. Fairfield, and F. S. Brewster. *American Foundrymen's Association, Preprint No.* 48-39, 1948, 8 pages.

Gas pressure within a core or molding-sand specimen was determined by ramming a brass tube into the core. A sensitive diaphragm-type pressure gage was used. The specimens were immersed in a molten-lead bath held at 1200° F. Gas pressure was found to increase as moisture, seacoal, oil, or cereal content was increased. Extremely high mold hardness also increased gas pressure. The effect of baking time on core-gas pressure was also determined.

14a-79. Modernization of the "Small" Foundry. Lester B. Knight. *American Foundrymen's Association, Preprint No.* 48-53, 1948, 16 pages.

Importance of such factors as sales methods and prices, organization and personnel, cost control, patterns, rigging, production equipment and methods, wage incentives, plant layout, materials handling, good housekeeping, and mechanized facilities.

14a-80. Vnitrni Nalitky. (Internal Risers.) A. Bichler. *Hutnické Listy* (Metallurgical Topics), v. 3, Feb. 1948, p. 41-43.

Results of experiments in Czechoslovakia are not in agreement with those of Canadian foundries. The layer of sand between the envelopes of the internal riser formed by the casting and the internal riser does not transmit any appreciable amount of heat due to its low conductivity. Removal of internal risers presents great difficulties which cannot be overcome even by the use of Washburn plate.

14a-81. Gating System Designs Affect Pouring Rates. J. G. Mezoff and H. E. E. Elliott. *American Foundryman,* v. 13, April 1948, p. 107-112.

While Mg alloys were used in conducting the tests described, many of the principles established apply also to the casting of any metal. The effects on pouring rate of the following design factors were established: sprue cross-sectional area, sprue cross-sectional shape, sprue length, sprue taper, sprue-mouth design, and pouring-basin depth. Also studied was effect of pouring temperature. (Presented at 52nd annual meeting, A.F.A., Philadelphia, May 3-7, 1948.) (Also published as Preprint No. 48-33.)

14a-82. Does Metal Vapor Cause Sand Penetration? Silas G. Jones. *American Foundryman,* v. 13, April 1948, p. 139.

Evidence is cited for the belief that metal penetration of sand results from metal vapor or metal-laden gas passing through the sand.

14a-83. Controlling Sand Grain Distribution Reduces Steel Foundry Costs. C. A. Sanders. *American Foundryman,* v. 13, April 1948, p. 142-146.

Recommends use of actual grain distribution data rather than A.F.A. fineness numbers for comparison and selection of sands. Control of the grain-distribution curve results in considerable savings in amounts of silica flour, bonding material, wood flour, and other additives to molding sand. 24 ref. (Presented at Ohio Regional Foundry Conference, Cleveland, March 11-12, 1948.)

14a-84. Preparing Foundry Sand With Manganese Resinate. F. Fere. *American Foundryman,* v. 13, April 1948, p. 147-149.

Procedure was developed in France. It was common practice to use linseed oil as a binder, together with a cohesion-improving agent such as molasses. However, the cores had a tendency toward deformation under their own weight. This difficulty was remedied by baking with "resinates", prepared by reaction of PbO_2 or MnO_2 with natural resins. These, in turn, copolymerize with the linseed oil on baking, and form good cores.

14a-85. Foundry Practice. H. W. Lownie, Jr. *Metals Review,* v. 21, April 1948, p. 3, 5, 7, 9.

Survey of literature for the past year begins with discussion of economic trends.

14a-86. Foundry Equipment. *Metals Review,* v. 21, April 1948, p. 11, 13, 15, 17, 19, 21, 23.

Products, materials, and services for the foundryman, introduced during the past year.

14a-87. Commercial Possibilities of the Lost Wax Process. A. Short. *Aircraft Engineering,* v. 20, April 1948, p. 105-108.

Process as it is used at present time on production. Further developments of the process, and production costs of some castings together with production limitations and possibilities.

14a-88. The Danish Foundry Industry. Ove Hoff. *Foundry Trade Journal,* v. 84, April 1, 1948, p. 323-324, 328.

Some novel developments. (To be continued.)

14a-89. The Flowability of Molding Sand With Special Reference to the Shatter Test. *Foundry Trade Journal,* v. 84, April 15, 1948, p. 365-367.

A guide to sand control methods based on test results. A condensation from paper presented at the February meeting of the Birmingham, Coventry, and West Midland Branch of the Institute of British Foundrymen.

14a-90. Venting of Cores and Molds. D. Killingworth. *Foundry Trade Journal,* v. 84, April 22, 1948, p. 389-394.

Results of a study and methods for evacuation of gases to prevent blowholes.

14a-91. Precision in Castings. *Business Week,* May 15, 1948, p. 64, 69.

Trends in foundry practice.

14a-92. A Critical Survey of Investment Casting. Rawson L. Wood and Davidlee Vo.i Ludwig. *Iron Age,* v. 161, May 6, 1948, p. 72-78; May 13, 1948, p. 90-94, 140, 142.

Information and data necessary to intelligently appraise the potentialities of investment casting as a means of reducing costs or improving performance. The various metals and alloys used for the process and their advantages and disadvantages. Design consideration. 11 ref.

14b—Ferrous

14b-46. Seventh Annual Report on Investigation of Properties of Steel Sands at Elevated Temperatures. D. C. Williams and P. E. Kyle. *Transactions of the American Foundrymen's Association,* v. 55, 1947, p. 607-619.

Work on the Sand Research Project sponsored by the Sand Division of the A.F.A. which has been completed during 1946 at Cornell University. The research furnace; results of a study of reproducibility of hot-compressive-strength test data; determination of exposure time required to heat all parts of the test specimen to the same temperature; determination of hot compressive strength vs. test temperature for several sand mixtures.

14b-47. Pratique Recente de la Fabrication au Cubilot de la Malléable a Coeur Noir en Tchécoslovaquie. (Recent Practice in the Cupola Production of Black-Heart Cast Iron in Czechoslovakia.) Milos Knotek. *Fonderie,* Dec. 1947, p. 961; discussion, p. 962.

Includes chemical composition.

14b-48. Rings, Pistons and Liners; A Review of the Production Methods Employed by Hepworth and Grandage, Ltd. *Automobile Engineer,* v. 38, Jan. 1948, p. 27-39.

Procedures and equipment for casting, machining, and inspection. Plain and alloy cast irons are used. (To be continued.)

14b-49. Giant Castings for Grand Coulee. *Western Machinery and Steel World,* v. 39, April 1948, p. 82-85.

Production of castings weighing 19 to 35 tons apiece for immense centrifugal pumps.

14b-50. Flywheel for Brazil. *Western Machinery and Steel World,* v. 39, April 1948, p. 89.

Casting of 11-ton flywheel for a 900-hp. diesel.

14b-51. Advances in British Steel Casting Technique. *British Steelmaker,* v. 14, April 1948, p. 159-164.

Practice at one foundry.

14b-52. Steel Castings; Straight-Line Production at K. & L. Steelfounders. *Iron and Steel,* v. 21, April 1948, p. 124-128.

14b-53. Gray Iron Foundry Modernized. V. E. Hillman. *Iron Age,* v. 161, April 22, 1948, p. 84-89.

Intensive mechanization of processing operations, coupled with modern materials-handling techniques and effective dust-control equipment at modernized gray-iron foundry.

14b-54. Modernized Foundry Stresses Good Working Conditions. *Foundry,* v. 76, May 1948, p. 120-125, 280, 282, 284.

Equipment, procedures, and layout of new ferrous foundry.

14b-55. Observations on Knock-Off Risers as Applied to Steel Castings. S. W. Brinson and Joseph A. Duma. *American Foundrymen's Association, Preprint No.* 48-9, 1948, 15 pages.

Knock-off risers are differenti-

(Turn to page 40)

15 Elements Impart Age Hardenability To Nickel Alloys

Reported by F. G. Wayman
Asst. Supt., Wire Mill
The Steel Co. of Canada, Ltd.

An address on "Age Hardenable Nickel Alloys" by William A. Mudge, director of technical services on mill products, International Nickel Co., Inc., before the Montreal Chapter A.S.M. on May 3, dealt mainly with the properties of various nickel alloys produced by the addition of age-hardenable elements.

"Since 1919 many workers have applied the fundamentals discovered in 1906 whereby nickel alloys age harden in a manner opposite to steel," stated Dr. Mudge, "and every day we learn of new alloys with increasingly interesting physical properties."

There are some 15 elements that impart age hardening properties to nickel, the speaker pointed out. The most common elements are magnesium, beryllium, aluminum, titanium, and silicon, but elements such as molybdenum, tungsten, zinc, manganese, tin, gold, and zirconium can be used.

Hardening is based on the formation of a compound of nickel with one or more hardening elements and by varying the amounts present, wide variations in physical properties of the alloys can be obtained. Small amounts of expensive alloys can be substituted for large amounts of cheaper alloys to get similar properties, but usually commercial adaptation of the alloy is the governing factor. Hardenability can be obtained in alloys containing as low as 8% nickel and as much as 94% nickel.

These alloys are soft when quenched from a high temperature, but when heated to a somewhat lower temperature and allowed to cool slowly, a hard alloy results. Hardening does not take place at a single temperature but the temperature most used commercially is the one that gives the greatest amount of hardness in the shortest possible time.

By cold working prior to age hardening or by cold working after age hardening, the hardening time can be decreased. It makes no difference whether the cold work is done prior to or after aging since the final result is the same in each case.

Hardened nickel alloys do not become brittle because the precipitated particles are extremely small; in some alloys, they are submicroscopic. Magnetic and electrical characteristics of the alloy are greatly influenced by the age hardening elements present, and careful consideration should be given to the application of the hardened alloy.

Montreal Chapter Honors Retiring Secretary

Reported by F. G. Wayman
Asst. Supt., Wire Mill
The Steel Co. of Canada, Ltd.

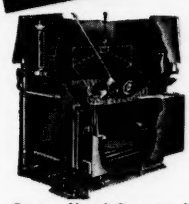
At the regular monthly dinner meeting of the Montreal Chapter A.S.M. on May 3, the members of the chapter reluctantly said adieu to their secretary. Mrs. B. W. McGillivray retired after 15 years' continuous service as secretary, and her resignation was accepted with considerable regret.

Mrs. McGillivray

As a token of the high esteem with which she is regarded by her many friends, she was presented with a sterling silver tea service. E. A. Dejean, chairman, made the presentation on behalf of the past chairmen, officers, and members of the Montreal Chapter.

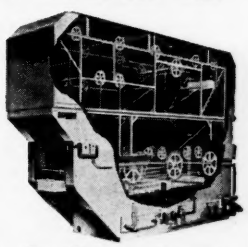
Mrs. McGillivray graciously thanked Mr. Dejean amidst cheers and the tune "For She's a Jolly Good Fellow" sung by those present.

You'll SAVE on EVERY Metal-Cleaning Job with DETREX Machines and Cleaning Agents



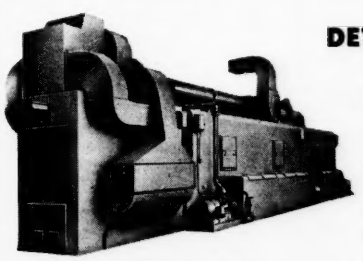
Detrex Hand-Operated Vapor-Slush Degreaser

DETREX builds all sizes of hand-operated and conveyorized degreasers and washers for parts of every shape and size from needles to auto bodies—castings, forgings, tubing, wire and stampings — ferrous, nonferrous and mixed loads —in any volume desired.



Three-Dip Detrex Degreaser with Cross-Rod Conveyor

For most jobs, *standard* Detrex machines provide top speed and economy, either used "as is" or with minor modifications. For the really unusual jobs, special machines are designed and built to assure the same top efficiency.



Conveyorized Detrex Multi-Stage Washer with Three Spray Zones and Blowoff

DETREX SPECIALIZED CLEANING AGENTS Include:

DEGREASING SOLVENTS for

★ *Both ferrous and non-ferrous metals, and adverse operating conditions*—PERM-A-CLOR, the most highly stabilized of all trichlorethylene solvents.

★ *Average applications*—TRIAD, identical to Perm-A-Clor in cleaning power.

ALKALI and EMULSION CLEANERS for

★ *Aluminum* parts and *painted surfaces.*
★ *Brass, aluminum* and *white metal* parts.
★ *Heavy-duty* cleaning of *iron, steel* and their alloys.
★ Cleaning and neutralizing prior to *vitreous enameling.*
★ *Electrolytic cleaning* especially for plating.
★ *Heavy-duty stripping* of pigmented oil paints, synthetics, and baked enamels.
★ *Removing all kinds of oils and insoluble dirt,* without attack on surface or coating.

Detrex machines and cleaning agents, *fitted to the job,* assure fast and thorough cleaning at lowest cost. That's why it pays to see your Detrex man on *every* metal-cleaning application

DETREX Corporation
DETROIT 32, MICHIGAN

ated from necked-down risers. Some quantitative information is presented showing important relationships among the variables which govern the successful use of knock-off risers in cast-steel applications. 10 ref.

14b-56. Contraction and Distortion in Gray Iron Castings. E. Longden. **American Foundrymens' Association, Preprint No.** 48-10, 21 pages.

Problems involved in cooling large castings without excessive distortion, especially for castings of unsymmetrical design. Test procedures for obtaining a continuous record of dimensional changes during cooling. Machine-tool beds, boring bars, and gear-blank castings were tested. Results led to adoption of localized air cooling for the beds. A "cambergraph" is presented which may be used to calculate allowances for shrinkage and contraction of a variety of castings. Differences between steel and cast iron are illustrated by application to a typical gear-blank casting.

14b-57. Causes of Rat-Tail Casting Defect. *American Foundrymen's Association, Preprint No.* 48-15, 1948, 21 pages.

The rat-tail phenomenon was studied by the A.F.A. committee on physical properties of iron-foundry molding materials at elevated temperatures by making flat gray-iron castings in a number of different sands. There were indications that metal pouring temperatures, green strength, and sand moisture content were not major causes. Expansion and hot strength at 1000° F. appear to be directly correlated to the tendency of a sand to produce rat-tails.

14b-58. Studies of Solidification of White Iron Castings. Victor Paschkis. *American Foundrymen's Association, Preprint No.* 48-17, 1948, p. 9-11.

Previous work has been concentrated mainly on steel castings. It has been shown that freezing rates obtained by the electric analogy method check well with results obtained from bleeding tests. Data for white iron castings also show reasonably good agreement between the two methods.

14b-59. Study on Solidification of Steel Spheres. Victor Paschkis. *American Foundrymen's Association, Preprint No.* 48-17, 1948, p. 11-15.

Previous work, with the Heat and Mass Flow Analyzer on solidification of castings was limited to slabs which were so big that the end effect could be neglected. It appeared desirable to study the solidification of steel spheres by comparing these results with those of Briggs and Gezelius in order to establish cooling curves for spheres. Experiments reported were concentrated on 4½ and 6-in. spheres. Results show good agreement with those of Briggs and Gezelius, except for 2740° F., which is near the liquidus temperature.

14b-60. Applications of Correlation in the Malleable Iron Foundry. Robert G. Seidel. *American Foundrymen's Association, Preprint No.* 48-22, 1948, 4 pages.

Correlation techniques and their possibilities for the above.

14b-61. New Centrifugal Process Produces Soil Pipe. R. L. Farabee. *American Foundryman,* v. 13, April 1948, p. 134-136.

Development of a split permanent metal-mold process which produces a good quality of pipe without subsequent heat treating, and at an extremely high rate of production. It was found that if the pipe were removed from the mold as soon as it had solidified sufficiently to hold its shape, a primary metallographic structure containing a pearlitic matrix and with the remaining carbon in a preferred form of graphite would be obtained without the necessity of annealing. (Presented at the 16th Annual Foundry Practice Conference, A.F.A., Birmingham District Chapter, Birmingham, Ala. Feb. 12-14, 1948.)

14b-62. Coke Boosters. A Fallacy in Cupola Operation? *American Foundryman,* v. 13, April 1948, p. 137-139.

Use and misuse of coke boosters and recommended procedures as determined from experience. Second of a series, dealing with modern cupola operation, sponsored by the Cupola Research Committee of A.F.A. Other reports will appear in future issues.

14b-63. Belgian Foundry Produces Wear-Resistant Cast Iron. G. Halbart. *American Foundryman,* v. 13, April 1948, p. 140-141.

Equipment and procedures at Les Fonderies Magotteaux, Vaux-Les-Liege, Belgium, in production of hard cast irons and hypereutectoid steels for wear resistance.

14b-64. Brazilian Foundry Produces Chilled Car Wheels. M. M. Siqueira. *American Foundryman,* v. 13, April 1948, p. 150-152.

14b-65. Recent Technical Developments in the Production of Iron Castings. E. C. Dickinson. *Foundry Trade Journal,* v. 84, April 8, 1948, p. 341-344.

Nodular iron, cleaning, substitute materials, and dielectric heating. (To be concluded.)

14b-66. Melting Iron in Gas-Fired Crucibles. *Iron Age,* v. 161, April 29, 1948, p. 91-93.

Above practice is said to permit unusually close control of composition. Foundry described utilizes this method for producing irons with sulphur as low as 0.04%. This metal is used in producing wrenches, gears and other machine parts. Construction of the furnaces, particularly with respect to types of refractories used and fuel consumption.

14b-67. Control of Gray Iron Casting Defects. W. B. McFerrin. *Canadian Metals and Metallurgical Industries,* v.11, April 1948, p. 17-19, 34-35, 39.

Recommended procedures for reduction of defects to a minimum.

14b-68. Recent Technical Developments in the Production of Iron Castings. (Concluded.) E. C. Dickinson. *Foundry Trade Journal,* v. 84, April 15, 1948, p. 369-370.

Dielectric core drying, bonding materials, core wires, and drying shells.

14c—Nonferrous

14c-29. Influence des Conditions de Solidification sur la Texture et la Répartition des Constituants dans les Ebauches de Fonderie. (Influence of Conditions of Solidification on Structure and Distribution of Constituents in Semifinished Castings.) Jean Herenguel. *Fonderie,* Dec. 1947, p. 980-981; discussion, p. 981.

Structure, segregation of inclusions, and cavities in nonferrous alloys were investigated under different conditions of solidification of test specimens.

14c-30. Nonferrous Founding. R. W. Eade. *Metal Industry,* v. 72, April 9, 1948, p. 283-285.

A plant description.

14c-31. Solidification Mechanism of Tin Bronzes. (Concluded) Clyde L. Frear. *Foundry,* v. 76, May 1948, p. 130-132, 348, 350-351.

Important considerations in the production of tin-bronze castings.

14c-32. Effect of Foundry Practice on Properties of Some Binary Copper-Silicon Alloys. I. Krynitsky, W. P. Saunders, and H. Stern. *American Foundrymen's Association, Preprint No.* 48-27, 1948, 12 pages.

Tensile properties of four different types of Cu-Si alloy bars containing 2.0 to 4.9% Si. Tensile strength increases with an increase in silicon content and a decrease in pouring temperature. An increase in the amount of precipitated constituents seems to be associated with an increase in tensile strength and a decrease in elongation. Effects of different atmospheres on physical properties of 4.9% Si alloy castings. The chief cause of unsoundness as determined by hydraulic pressure tests was the presence of interconnected shrinkage cavities caused by inadequate feeding. 16 ref.

14c-33. The Roosevelt Memorial; An Outstanding Example of British Art Bronze Founding. A. L. Parrott. *Metal Industry,* v. 72, April 16, 1948, p. 304-309.

Steps in the casting of a large statue of the late Franklin Delano Roosevelt, which was recently dedicated in London.

14c-34. Solution for a Knotty Problem. *Die Castings,* v. 6, May 1948, p. 38-40, 46-47.

Die with knockout core was chosen in preference to a heavily machined sand casting for complicated part on mechanism for knitting machine.

14d—Light Metals

14d-29. Machine Automatique Pour la Coulée en Coquille d'Alliage d'Aluminium. Perfectionnement au Demoulage des Noyaux Pour le Moulage en Coquille. (Automatic Machine for Chill Casting of Aluminum Alloys. Improved Method for Stripping the Core in Chill Casting.) Rene Bourret. *Fonderie,* Dec. 1947, p. 982-983; discussion, p. 983-984.

Machine is described, as well as the proposed method of core stripping. Advantages.

14d-30. Pilot Aluminum Foundry for New Product Development. J. T. Underwood. *Modern Metals,* v. 4, April 1948, p. 17-21.

Pilot foundry for development of aluminum products.

14d-31. A Foundry Problem. *Metal Industry,* v. 72, April 9, 1948, p. 293.

An example of an Al alloy in which difficulty from entrapped gas from the core was experienced and method developed for elimination of the difficulty.

14d-32. Effect of Gating Design on Metal Flow Conditions in the Casting of Magnesium Alloys. H. E. Elliott and J. G. Mezoff. *American Foundrymen's Association, Preprint No.* 48-6, 22 pages.

Design of the gating system is correlated with degree of turbulence which occurs during the pouring of Mg-alloy castings, and with casting quality. Improper sprue design may lead to casting defects by entrainment of gases in the metal stream. Further work indicated that three casting defects may be caused or exaggerated by gating turbulence; namely, skins, blows, and microporosity. The value of skim-gates as a method of controlling gating turbulence.

14d-33. Studies on the Solidification of Aluminum Castings. Victor Paschkis. *American Foundrymen's Association. Preprint No.* 48-17, 1948, p. 4-9.

Previous reports covered a com-

(Turn to page 42)

Metallurgical Books

By Sibyl E. Warren

Lingren Library, Mass. Inst. of Technology

A Bibliography, Classified by Subject Matter, of Metallurgical and Near-Metallurgical Books Published in the Years 1936-1946

THIS IS THE fourth installment in this bibliography, which began in the March issue of *Metals Review*. The present portion includes Section B-4 on Testing and Mechanical Properties, and Section B-5 on Corrosion and Oxidation. Subsequent issues will carry succeeding sections of the bibliography.

* * *

B-4. Testing and Mechanical Properties

American Society for Testing Materials. **Book of A.S.T.M. Standards. Pt. 1. Metals.** Society, Philadelphia, 1936; 1937 (Suppl.); 1938 (Suppl.); 1939; 1940 (Suppl.); 1941 (Suppl.); 1942; 1943 (Suppl.); 1944; 1945 (Suppl.); 1946.

American Society for Testing Materials. **Symposium on Magnetic Particle Testing.** Society, Philadelphia, 1945, 122 p.

American Society for Testing Materials. Philadelphia District Committee. **Symposium on Wear of Metals.** Society, Philadelphia, 1937, 105 p.

Beaumont, R. A. **Mechanical Testing of Metallic Materials, With Special Reference to Proof Stress.** Ed. 2. I. Pitman and Sons, Ltd., London, 1944, 142 p.

Bungardt, K. and Damerow, E. **Die Prufung der metallischen Werkstoffe.** J. Springer, Berlin, 1939, 744 p.

Chalmers, Bruce. **Physical Examination of Metals.** Longmans, Green & Co., New York, 1939-1941, 2 v. (v. 2 with A. G. Quarrell.)

Churchill, H. D. **Physical Testing of Metals and Interpretation of Test Results.** American Society for Metals, Cleveland, 1936, 109 p.

Clark, W. A. and Plehn, Brainerd. **Materials Testing and Heat Treating.** Harper and Brothers, New York, 1942, 132 p.

Cowdrey, I. H. and Adams, R. G. **Materials Testing: Theory and Practice.** Ed. 2. John Wiley & Sons, Inc., New York, 1944, 134 p.

Damerow, Ernst and Herr, Adolph. **Hilfsbuch fur die praktische Werkstoffabnahme in der Metallindustrie.** Ed. 2. J. Springer, Berlin, 1941, 117 p.

Doane, F. B. and Thomas, W. E. **Magnaflux Aircraft Inspection Manual.** Photopress, Inc., Chicago, 1941, 193 p.

Doane, F. B. **Principles of Magnaflux Inspection.** Photopress, Inc., Chicago, 1940, 133 p.

Doane, F. B. **Principles of Magnaflux Inspection.** Ed. 2. Photopress, Inc., Chicago, 1943, 288 p.

Enos, G. M. **Visual Examination of Steel.** American Society for Metals, Cleveland, 1940, 123 p.

Foster, P. F. **The Mechanical Testing of Metals and Alloys.** Ed. 3. I. Pitman and Co., London, 1942, 317 p.

Frocht, M. M. **Photo-Elasticity.** John Wiley & Sons, Inc., New York, 1941, v. 1, 378 p.

Gensamer, Maxwell. **Strength of Metals Under Combined Stresses.** American Society for Metals, Cleveland, 1941, 106 p.

Gillett, H. W. **An Engineering Approach to the Selection, Evaluation and Specification of Metallic Materials.** Penton Publishing Co., Cleveland, 1944, 140 p.

Gillett, H. W. **Impact Resistance and Tensile Properties of Metals at Subatmospheric Temperatures.** American Society for Testing Materials, Philadelphia, 1941, 112 p.

Landau, David. **Hardness.** Nitralloy Corp., New York, 1943, 105 p.

Muhlenbruch, C. W. **Testing of Engineering Materials.** Van Nostrand Co., New York, 1944, 200 p.

Neuber, Heinz. **Kerbspannungslehre.** J. Springer, Berlin, 1937, 160 p.

Pulsifer, H. B. **Inspection of Metals.** American Society for Metals, Cleveland, 1941, 180 p.

Schiebold, Ernst. **Spannungsmessung an Werkstucken.** Akademische Verlagsgesellschaft, Leipzig, 1938, 216 p.

Siebel, Erich and Graf, Otto. **Handbuch der Werkstoffpruefung.** J. Springer, Berlin, 1940-1941, 3 v.

Williams, S. R. **Hardness and Hardness Measurements.** American Society for Metals, Cleveland, 1942, 558 p.

B-5. Corrosion & Oxidation

American Society for Metals. **Corrosion of Metals.** Society, Cleveland, 1946, 192 p.

American Society for Testing Materials. **Symposium on Atmospheric Exposure Tests on Nonferrous Metals.** Society, Philadelphia, 1946, 145 p.

American Society for Testing Materials & American Institute of Mining & Metallurgical Engineers. **Symposium on Stress-Corrosion Cracking of Metals.** Institute, New York, 1945, 500 p.

American Society for Testing Materials. **Symposium on Corrosion Testing Procedures.** Society, Philadelphia, 1937, 131 p.

Arkharov, V. I. **Okislenie metallov pri vysokikh temperaturakh.** Gosudarstvennoe nauchno-tekhnicheskoe izdatel'stvo, Moskva, 1945, 170 p.

Bauer, Oswald, Krohnke, O. and Masing, G., editors. **Die Korrosion metallischer Werkstoffe.** v. 1-3 S. Hirzel, Leipzig, 1936-1941.

Burns, R. M. and Schuh, A. E. **Protective Coatings for Metals.** Reinhold Publishing Corp., New York, 1939, 407 p.

Evans, U. R. **Metallic Corrosion, Passivity and Protection.** Edward Arnold and Co., London, 1937, 720 p.

(*Turn to page* 43)

Classification Scheme

1. Metallurgy (in General)

(A) Process Metallurgy

1. Ore Dressing
2. Pyrometallurgy, Hydrometallurgy, Electrometallurgy
3. Furnaces, Refractories, Fuels, Slags, Temperature, Pyrometry

(B) Physical Metallurgy

1. Structure and Properties of Metals and Alloys
   (a) Phase Relations
2. Metallography
   (a) Microscope, Polishing, Etching
   (b) X-Ray Analysis, Radiography
3. Heat Treating
4. Testing and Mechanical Properties
5. Corrosion and Oxidation

(C) Mechanical Metallurgy

1. Powder Metallurgy
2. Casting
   (a) Patterns, Molds, Foundry Sands
3. Welding and Cutting
   (a) Electric
   (b) Gas
   (c) Soldering
4. Other Processes: Forging, Rolling, Extrusion, Drawing, Stamping, Spinning, Machining
5. Surface Treatment
   (a) Plating, Galvanizing
   (b) Enameling, Coloring, Spraying
   (c) Others

II. Metals (in General)

(a) Analysis

(A) Ferrous

(a) Biography, Economics, History

1. Iron
   (a) Cast
   (b) Iron and its Alloys
2. Steel
   (a) Special Steels

(B) Nonferrous

1. Aluminum, Magnesium
2. Brass, Bronze, and Bearing Metals
3. Copper
4. Gold, Silver, Platinum, and Other Precious Metals
5. Other Nonferrous Metals and Alloys

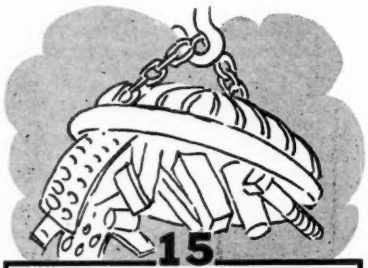
parison between bleeding tests and tests by the electric-analogy method on the solidification of steel and of white cast iron. The present report deals with a similar comparison for the solidification of pure aluminum.

14d-34. Structurally Sound Cast Parts Provided by Aluminum Base Alloy Pressure Molding. James L. Erickson. *Steel,* v. 122, May 3, 1948, p. 98-100.

Process, an outgrowth of the die-casting process, which minimizes trapped-air porosity, heterogeneous macro and microstructure, cold shuts, and oxide inclusions by avoiding turbulence during the casting process.

For additional annotations indexed in other sections, see:

2b-77; 2c-29; 3d-23; 4a-19; 17-37; 21a-77; 27c-12.



15 SCRAP and BYPRODUCT UTILIZATION

15a—General

15a-6. Some Suggestions for the Disposal of Ferrous Sulphate From Waste Pickle Liquor. Paul de Lattre. *Sheet Metal Industries,* v. 25, April 1948, p. 697-703, 716.

Direct uses and conversion to other salable products. Technical, mechanical, and economic problems. 24 ref.

15b—Ferrous

15b-15. Preparation and Charging of Scrap. Clyde Denlinger. *Proceedings, National Open Hearth Committee, Iron and Steel Division, American Institute of Mining and Metallurgical Engineers,* v. 30, 1947, p. 53-55; discussion, p. 55-61.

Recommended procedures for the basic openhearth; a short preliminary to an extended discussion.

15b-16. Reconditioning of Used Rolling-Mill Rolls by Deposition of Metal Using Welding Techniques. (In Russian.) Yu. A. Kalachev. *Avtogennoe Delo* (Welding), Jan. 1948, p. 29-30.

15b-17. Soldering of a Cast-Iron Part Using Hard Solder. (In Russian.) N. P. Nikitin. *Avtogennoe Delo* (Welding), Jan. 1948, p. 31.

Composition of solder and method of application.

15b-18. Economies Resulting From Arc Welding. W. G. Ough. *Canadian Mining Journal,* v. 69, Jan. 1948, p. 60-63.

Use in repair and maintenance by a Mexican company, which treats gold and silver ores by the cyanidation process.

15b-19. Repairs to Farming Equipment; Applications of Oxy-Acetylene Welding. F. Clark and R. C. Hesketh Jones. *Welding,* v. 16, April 1948, p. 138-144.

15b-20. Major Operations on Oil Tankers; the Restoration of a Fore-End. J. K. Johannesen. *Welding,* v. 16, April 1948, p. 157-162.

Details of welding-repair operations. (To be concluded.)

15b-21. Sanitarium for Drums. *Industrial and Engineering Chemistry,* v. 40, May 1948, p. 20A, 22A.

Methods used in reconditioning of steel drums.

15b-22. Production Repair of Alloy Steel Castings. John W. Juppenlatz. *Industry and Welding,* v. 21, May 1948, p. 26-29, 49-50, 52.

A picture story with emphasis on welding.

15b-23. Scrap Critical National Resource. *Steel,* v. 122, May 3, 1948, p. 61-68.

A special report by the editors of *Steel* for iron and steel.

15b-24. Dam Gets a Face Lifting. Henry W. Young. *Welding Engineer,* v. 33, May 1948, p. 46-48, 51.

Concrete slabs were skin grafted to the worn-out face of Barker dam by lap welding steel dowels embedded in the slabs to steel anchor bars grouted into the face. Intervening space was then backfilled.

15b-25. Farm Equipment Remade. Ernest J. Koop. *Welding Engineer,* v. 33. May 1948, p. 54-55, 64.

Welding repairs.

15b-26. Unlocking Davy Jones' Locker. Clarence Judd. *Steelways,* May 1948, p. 10-12.

Steel-scrap salvage from the sea.

15b-27. New Show Goes on the Road. *Steelways,* May 1948, p. 30-31.

Metalworking procedures involved in modernization of steel railway coaches.

15b-28. Blowpipe Cutting Employed to Reclaim Ladle Skulls and Buttons. *Steel,* v. 122, May 17, 1948, p. 94, 97.

Application of gas-cutting installation for reclamation of heavy scrap long considered too costly to recover in charging box sizes. The oxygen lance is used on large skulls and the blowpipe on smaller sizes. Cutting speed varies from 2 to 6 in. per min. Cost of recovery is $4.50 a ton.

15c—Nonferrous

15c-4. Scrap Brass; Distillation of Zinc and Refining of Residual Copper. F. F. Roland. *Metal Industry,* v. 72, April 23, 1948, p. 331-332.

The recovery of copper from scrap brass by distilling off the zinc was described by the same author in the Nov. 29, 1946 issue. Subsequent developments are discussed in this article.

For additional annotations indexed in other sections, see:

7a-118; 22b-135.

An indispensable reference book covering everything from constitution of alloys to mechanical working

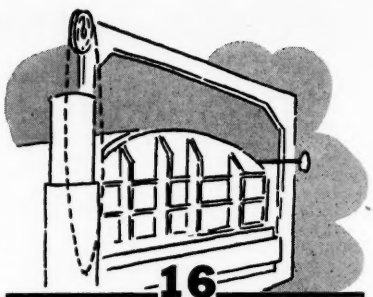
PRACTICAL METALLURGY

by George Sachs and Kent R. Van Horn

567 pages—$5.00

American Society for Metals

7301 Euclid Ave. Cleveland 3, Ohio



16 FURNACES and HEATING DEVICES

16a—General

16a-37. Bibliography on High-Frequency Dielectric Heating. *American Institute of Electrical Engineers,* Aug. 1947, 19 pages.

Domestic references; foreign patents; and author index. Contains 393 annotated references covering period from 1925 to July 31, 1946.

16a-38. Determination of Maximum Temperatures in Combustion Chambers and Industrial Furnaces. (In Russian.) I. E. Kubynin. *Zhurnal Tekhnicheskoi Fiziki* (Journal of Technical Physics), v. 17, Dec. 1947, p. 1411-1414.

Mathematical formulas for determination of these temperatures. Curves of oxidation and reduction processes converge at a point located on the boundary between the oxidation and reduction zones where the temperature of combustion reaches its maximum.

16a-39. Temperature Range in the Combustion Zone. (In Russian.) I. E. Kubynin. *Zhurnal Tekhnicheskoi Fiziki* (Journal of Technical Physics), v. 17, Dec. 1947, p. 1415-1420.

A series of equations are proposed. Interpretation of the results and methods of application.

16a-40. Control of Heat Treatment: Part III. (Concluded.) A. H. Koch. *Industrial Heating,* v. 15, April 1948, p. 580, 582, 584, 586, 588, 712, 714.

Modern developments in both theory and practice in controlled atmospheres and atmosphere generators, and their possibilities and limitations. Methods of obtaining a proper quench from the various types of furnaces.

16a-41. Heating Methods for Controlled Atmosphere Furnaces. W. H. Holcroft and M. R. Larson. *Steel,* v. 122, April 26, 1948, p. 100-103.

Requirements of continuous muffle-type, radiant-tube and direct-electric heating furnaces for gas carburizing, carbo-nitriding, malleable annealing and other high-production processes.

16a-42. Combustion in Oxygen and Oxygen-Enriched Air. H. R. Fehling. *Engineers' Digest* (American Edition), v. 5, March-April 1948, p. 99-101; discussion, p. 101-102. Condensed from *Iron and Coal Trades Review,* v. 66, Jan. 23, 1948, p. 165-167, 177.

Fundamental and practical standpoints. Use of oxygen may eliminate need for regenerators on openhearth and similar furnaces.

16a-43. Design and Performance of a Refractory Recuperator. E. G. Smith. *Iron and Steel Engineer,* v. 25, April 1948, p. 106-112; discussion, p. 112.

The vertical tube refractory recuperator is said to be proving itself for soaking pits and slab-reheating furnaces. Possibility of its

(Turn to page 44)

METALLURGICAL BOOKS

Evans, U. R. **Metallic Corrosion, Passivity and Protection.** Ed. 2. Edward Arnold and Co., 1946, 863 p.

Ewing, S. P. **Soil Corrosion and Pipe Line Protection.** American Gas Association, New York, 1938, 277 p.

Gatty, Oliver and Spooner, E. C. R. **Electrode Potential Behavior of Corroding Metals in Aqueous Solutions.** Clarendon Press, Oxford, 1938, 504 p.

Grard, C. A. M. **La corrosion en métallurgie milieu aqueux, atmosphérique et marin.** Edit. Berger-Levrault, Paris, 1936, 348 p.

Guidi, C. and Guzzoni, G. **La corrosione dei metalli.** Ulrico Hoepli, Milan, 1937, 373 p.

Hudson, J. C. **Corrosion of Iron and Steel.** Chapman and Hall, Ltd., London, 1940, 319 p.

Larson, Erick. **Pipe Corrosion and Coatings.** With Chapter on **Cathodic Protection,** by G. I. Rhodes. American Gas Journal, Inc., New York, 1938, 455 p.

McKay, R. J. and Worthington, Robert. **Corrosion Resistance of Metals and Alloys.** Reinhold Publishing Corp., New York, 1936, 492 p.

Pavlov, S. Ye. **Corrosion of Clad Duralumin.** (In Russian.) Oborongizdat, Moscow, 1940, 144 p.

Ritter, Franz. **Korrosionstabellen metallischer Werkstoffe, geordnet nach angreifenden Stoffen.** J. Springer, Wien, 1937, 192 p.

Schikorr, Gerhard. **Die Zersetzungserscheinungen der Metalle. Eine Einfuhrung in die Korrosion der Metalle.** J. A. Barth, Leipzig, 1943, 232 p.

Siegel, August. **Korrosionen an Eisen und Nichteisenmetallen. Betriebserfahrungen in elektrischen Kraftwerken und auf Schiffen.** J. Springer, Berlin, 1938, 86 p.

Tödt, Fritz. **Messung und Verhutung der Metallkorrosion.** W. de Gruyter & Co., Berlin, 1941, 164 p.

Wiederholt, Wilhelm. **Metallschutz. v. 1. Ursachen der Korrosion und allgemeine Schutzmassnahmen.** B. G. Teubner, Leipzig, 1938, 106 p.

(To Be Continued)

New Film Pictures Rolling Mill

A five-minute sound motion picture film titled "The World's Fastest Steel Rolling Mill", which describes the new five-stand tandem mill at the Aliquippa Works, Pa., is available for distribution on request, it is announced by Jones & Laughlin Steel Corp.

Requests should be addressed to Motion Picture Distribution Manager, Advertising Department, Jones & Laughlin Steel Corp., 311 Ross St., Pittsburgh 30, Pa.

Texas Honors Chairmen, Krivobok Is Speaker

Reported by Harold W. Schmid

General Metals Corp.

The April meeting of the Texas Chapter A.S.M. honored the past Chairmen. Don (R. M.) Garrison, chapter chairman for 1939-40, now living in Quincy, Ill., traveled the greatest distance to attend. Other past chairmen present were:

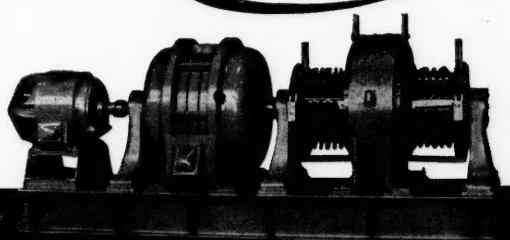
R. W. Schlumpf—1937-38 (first chairman)
Chas. H. Shapiro—1938-39
Geo. Harrington—1941-43
F. M. Wittlinger—1943-44
Carl S. Cook—1944-45
W. E. Burndrett—1945-46

Wade Hampton, 1940-41, was the only absentee.

The speaker of the evening, V. N. Krivobok, of International Nickel Co., gave an illustrated talk on "Stainless Steel Production Problems."

Some of the points discussed were the effect of comparatively small differences in composition on ultimate results obtainable, the differences between the straight chromium types and the nickel-chromium types, and the many and varied problems in hot and cold working. The discussion and question period following the talk furnished information on specific problems.

Motor Generators by COLUMBIA



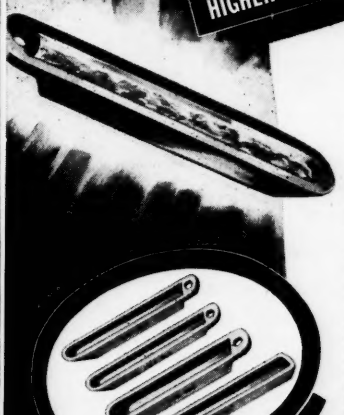
For
Electroplating — Anodizing
Electrocleaning — Electropolishing

There's a Columbia M-G Set available for your needs, whether you have a small plating bath or a large continuous strip plating line. Capacities up to 20,000 Amperes; 6 Volts and up. Dependable performance proved for many years. Your inquiries solicited.

Write today for Catalog MR-700

COLUMBIA ELECTRIC MFG. CO.
4539 HAMILTON AVENUE CLEVELAND 14, OHIO

The trend is toward HIGHER COMBUSTION TEMPERATURES



LECO COMBUSTION BOATS

have been designed to withstand temperatures up to 2700° Fahrenheit.

In addition they give you these features:

- Fast preheating because of light weight.
- Resist heat shock to permit reuse of the boat for repeated combustions.
- Sulphur free.
- Carbon free, except as contaminated from handling.
- *VERY LOW COST*

There is a Leco Combustion Boat to suit your every requirement. Large stocks of standard shapes and sizes are maintained to assure immediate delivery. Special shapes may be furnished upon request.

Compare the Leco boat with any other on the market. We will furnish you free samples for this purpose.

LABORATORY EQUIPMENT CORPORATION
BENTON HARBOR, MICHIGAN

application to the openhearth. Comparison for several types and advantages over direct-fired furnaces and soaking pits. (Presented at A.I.S.E. annual convention, Pittsburgh, Sept. 25, 1947.)

16a-44. National Tube Builds New Coke Plant at Lorain. *Iron and Steel Engineer,* v. 25, April 1948, p. 113-115.

16a-45. Recirculation of Gases. E. Watkinson. *Journal of the Institute of Fuel,* v. 21, April 1948, p. 177-184.

Recirculation of gases is common practice with many types of furnaces, stoves, ovens, and heat exchangers working at 850° C. and under. Typical examples include the heat treatment of steel, the heating, heat treatment and aging of aluminum and its alloys, the drying and baking of molds and cores used in foundry practice; and many other processes.

16a-46. Make Your Furnace-Design Specifications Work for You. N. J. Connors. *Power,* v. 92, May 1948, p. 102-104.

Recommends writing specifications in terms that relate heat release to performance, gas temperatures to measurement, and ash to firing.

16a-47. High Temperature Vacuum Furnace. *Iron Age,* v. 161, May 6, 1948, p. 93.

Construction of Swedish furnace suitable for temperatures up to 3990° F., described more fully in *Engineers' Digest,* Dec. 1947, p. 578.

16a-48. Furnaces and Fuels for Heat Processing Metals. Floyd E. Harris. *Steel,* v. 122, May 10, 1948, p. 90-94.

Controlling factors involved in attacking heating problems and in determining atmosphere applications and surface effects are analyzed in order to improve equipment.

16b—Ferrous

16b-35. Les Fours de Recuit de la Malléable. (Annealing Furnaces for Malleable Cast Iron.) Gabriel Joly. *Fonderie,* Dec. 1947, p. 965-969; discussion, p. 969-970.

Types of furnaces were investigated.

16b-36. Liquid-Fuel Firing, With Special Reference to Openhearth Furnaces. F. A. Gray. *Iron and Steel Institute, Special Report* No. 39, "Reports of the Affiliated Local Societies", Dec. 1947, p. 60-80.

Properties of available liquid fuels; in particular, oil fuels are considered with regard to their use in the openhearth furnace. Liquid fuels are compared with other openhearth fuels; in particular, oil fuels are conpower, furnace efficiency, steel output and quality, and furnace design. Oil-firing equipment and required modifications in the design of gas-fired furnaces.

16b-37. The Thermal Efficiency and Economics of Oil Firing. G. Reginald Bashforth. *British Steelmaker,* v. 14, April 1948, p. 170-176.

Based on a panel discussion. Refers to the iron and steel industry. 11 ref.

16b-38. World's Largest Salt Bath for Descaling Plate and Sheet. John S. Morris. *Industrial Heating,* v. 15, April 1948, p. 568-572, 574, 576, 578, 710, 720, 722.

Electrically heated salt pot, believed to be the largest of its kind in the world, is 40 ft. long, 6 ft. 4 in. wide and 12 ft. deep. Other equipment also described.

16b-39. Soaking Pit Operation. *Industrial Heating,* v. 15, April 1948, p. 616, 618, 620, 622. Condensed from paper by H. V. Flagg.

Various designs of soaking pits and some difficulties encountered in their operation. (Presented at recent annual convention, A.I.S.E., Pittsburgh.)

16b-40. Large Conveyerized Core Ovens Feature Ford Foundry Rehabilitation Program. *Industrial Heating,* v. 15, April 1948, p. 647-648, 650, 652, 654, 656, 658.

(To be continued.)

16b-41. Construction and Operation of an Oil-Fired Malleable Iron Holding Furnace. F. Coghlin, Jr. *American Foundrymen's Association, Preprint* No. 48-18, 8 pages; discussion, p. 8.

The refractory layout, the oil-burner system, the atmosphere-control system, operating methods and data, and some brief comparisons with coal firing.

16b-42. Flush-Hole Maintenance. G. C Lawton. *Proceedings, National Open Hearth Committee, Iron and Steel Division, American Institute of Mining and Metallurgical Engineers,* v. 30, 1947, p. 83-85; discussion, p. 85-88.

Experiences at Inland Steel while shifting from scrap to high-metal basic openhearth practice. Recommendations for reduction of flush-hole losses.

16b-43. Bottom Maintenance. J. P. L. McMahon. *Proceedings, National Open Hearth Committee, Iron and Steel Division, American Institute of Mining and Metallurgical Engineers,* v. 30, 1947, p. 89-90; discussion, p. 90-98.

Procedures recommended and practice at several mills.

16b-44. Furnace Maintenance. G. H. Todd. *Proceedings, National Open Hearth Committee, Iron and Steel Division, American Institute of Mining and Metallurgical Engineers,* v. 30, 1947, p. 98-104; discussion, p. 104-108.

Practice at Ashland mill of Armco. Discussion of practice at several other mills.

16b-45. The Application of Fuel Oil and Surplus Gas at an Integrated Iron and Steel Works. J. Sinclair Kerr. *Journal of the Institute of Fuel,* v. 21, April 1948, p. 165-176.

Utilization of surplus gases in an integrated iron and steel works. Stress is placed on the value of instrumentation and automatic control for obtaining consistent operating conditions. The use of fuel oil in place of producer gas for the firing of openhearth furnaces. The instrumentation required for an oil-fired furnace. Comparison is made between results obtained with oil firing on the ordinary 50-ton basic openhearth furnace and on an all-basic furnace of the same size fired by producer gas.

16b-46. Here's a Way to Preheat Castings. *Linde Tips,* v. 27, April 1948, p. 34-35.

Temporary firebrick furnace for preheating prior to welding.

16b-47. Novel Design for British Steel Melting Furnaces. Ian Cox. *Blast Furnace and Steel Plant,* v. 36, May 1948, p. 561.

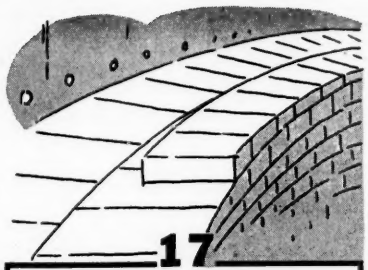
New type which allows more combustion and hotter flame.

16c—Nonferrous

16c-2. Gas-Fired Foundry Equipment Produces Quality Castings. *Industrial Heating,* v. 15, April 1948, p. 604, 606, 608, 610.

For additional annotations indexed in other sections, see:

14b-66; 18b-66; 19a-93.



17 REFRACTORIES and FURNACE MATERIALS

17-35. The Development of Refractories for High-Temperature Industrial Processes. A. Hilliard and F. H. McKee. *Refractories Journal,* v. 24, March 1948, p. 98-105.

Previously abstracted from *British Coal Utilisation Research Association Monthly Bulletin,* v. 11, Nov. 1947, p. 457-468. (To be continued.) See item 17-8, 1948.

17-36. Economic Considerations for Stack Lining Repairs. *Industrial Heating,* v. 15, April 1948, p. 664, 666. Condensed from paper by W. R. Trognitz.

Previously abstracted from *Steel,* v. 122, March 1, 1948, p. 110, 112. See item 17-24, 1948.

17-37. Testing Refractories for the Foundry. S. M. Swain. *American Foundrymen's Association, Preprint* No. 48-26, 1948, 14 pages.

Planning, selection of objectives, justification of costs, and safety factors for a testing program. Detailed recommendations are made for sampling brick and other refractory materials. Three general types of testing programs and recommendations for small and large foundries. 47 ref.

17-38. A Program for Reducing Bottom Troubles on Basic Openhearth Furnaces. R. Russell Fayles. *Proceedings, National Open Hearth Committee, Iron and Steel Division, American Institute of Mining and Metallurgical Engineers,* v. 30, 1947, p. 43-52.

Causes of trouble and recommended procedures for maintenance and selection of refractories.

17-39. Performance of Silica Brick. *Proceedings, National Open Hearth Committee, Iron and Steel Division, American Institute of Mining and Metallurgical Engineers,* v. 30, 1947, p. 202-204.

K. D. Bartels deals with experience with split roofs, effect of size variations in service, and fantail difficulties. Information also by Adam Lilly and M. F. Yarotsky.

17-40. Performance of Basic Brick. *Proceedings, National Open Hearth Committee, Iron and Steel Division, American Institute of Mining and Metallurgical Engineers,* v. 30, 1947, p. 204-205.

Experiences with insulating basic brick, by G. H. Johnson; and brief comments by Adam Lilly.

17-41. Basic Ends and Basic Roofs. *Proceedings, National Open Hearth Committee, Iron and Steel Division, American Institute of Mining and Metallurgical Engineers,* v. 30, 1947, p. 206-210.

Three short papers by A. K. Moore, C. R. FonDersmith, and W. J. Rielly dealing with experiences in maintenance, repair, and design.

17-42. Basic Rammed Doors. *Proceed-*

(Turn to page 46)

Officers and Teachers at M.C.M.T.

At the April Dinner Meeting of Michigan College of Mining and Technology are (Top Row, Left to Right): Prof. R. J. Marcotte; R. D. Schoch, Vice - Chairman; Prof. R. C. Steveling; Prof. R. W. Drier; and Prof. R. J. Smith. Bottom row: Prof. G. W. Boyd; T. E. Dennis, secretary-treasurer; R. J. Douslin of Wyman-Gordon Co., the speaker; and F. G. Giesiking, chapter chairman

Many Tests Needed for Judging Cutting Ability Of Various Small Tools

Reported by R. E. Christin
Columbus Bolt Works Co.

Every tool is a compromise, Ralph G. Kennedy, Jr., research metallurgist, Cleveland Twist Drill Co., told the Columbus Chapter A.S.M. on March 9, when he discussed some metallurgical aspects of small tool manufacture. In testing different tools against each other, a great many tests are needed before a good judgment can be made as to their relative cutting ability, he said. Tests made in one shop usually differ from supposedly similar tests made in another shop because the combinations of factors influencing the test results run into the hundred millions, and it is very difficult to conduct a truly controlled test.

Four classes of tool materials were listed, namely, (a) carbon tool steel; (b) high speed steel, with and without cobalt; (c) cast alloys; and (d) sintered carbides.

The possibility of reaming sintered carbides was a revelation to quite a number present. Pack annealing has been replaced by cyclic annealing, reducing the time by 90%.

Lively discussion followed when a member asked about the control of molten salts by carbon rectification. Another asked about subzero treatment, which appeared from the discussion to be favorable for high-carbon, high-chromium die steels in some cases, but to be of doubtful benefit to high speed steels.

Reported by Theodore E. Dennis
Michigan College of Mining and Technology

Light-metal forgings were discussed by J. R. Douslin of the Wyman-Gordon Co. before the Michigan College of Mining and Technology Chapter at a dinner-lecture meeting on April 15. Mr. Douslin outlined the recent growth of this field of metallurgy and described the problems involved and techniques developed.

Features of the talk included a pictorial description of the giant 18,000-ton hydraulic press, the construction of which made large light-metal forging possible. Metallurgical aspects of cross forging billet treatment were also covered.

In an extended question period the speaker answered questions concerning the preworking of cast ingots, the effect of grain size on workability and properties, and the usefulness of integral test procedures.

New Movie on Arc Welding

To assist the designer and engineer to use arc welded steel in the design of all types of machinery in many hundreds of different industries, the Lincoln Electric Company has recently released a new 16-mm. sound-color movie, "Designing Machinery for Arc Welding". The film, which has a running time of approximately 15 min., is available from the Lincoln Electric Co., Cleveland, at no charge (except transportation) by all interested industrial organizations, technical societies, schools, and colleges.

TECHNICAL DATA SHEET
ROCHELTEX
ROCHELTEX
CAN MAKE YOUR COPPER PLATING JOB EASIER
Rocheltex is recognized as one of the finest processes as a stop off for heat treating operations. It eliminates carburization and penetration.
Write now to Dept. R for Technical Data Sheets
MAC DERMID
Incorporated
WATERBURY 88, CONNECTICUT

ings, National Open Hearth Committee, Iron and Steel Division, American Institute of Mining and Metallurgical Engineers, v. 30, 1947, p. 210-214.

Four brief contributions by C. W. Drabers, L. R. Berner, H. E. Warren, and G. H. Johnston (who outlines experiences with metal-clad brick doors).

17-43. Trends in Bottom Construction. John Topping and A. W. Robinson. *Proceedings, National Open Hearth Committee, Iron and Steel Division, American Institute of Mining and Metallurgical Engineers,* v. 30, 1947, p. 214-217.

Results of a questionnaire survey.

17-44. Comparison of Tests for Bulk Density of Fired Ramming Materials, and a Description of a Test for Magnesite-Slag Mixes. R. B. Snow and C. E. Sumpter. *Proceedings, National Open Hearth Committee, Iron and Steel Division, American Institute of Mining and Metallurgical Engineers,* v. 30, 1947, p. 217-221.

Results of tests, which are still in the development stage, are described in order to stimulate further investigation and thought on the testing of coarse-aggregate mixes, which, it is believed, are not adequately covered by existing A.S.T.M. specifications.

17-45. Air-Chamber Checkers. B. L. Dorsey. *Proceedings, National Open Hearth Committee, Iron and Steel Division, American Institute of Mining and Metallurgical Engineers,* v. 30, 1947, p. 222-224.

Construction and average life in five furnaces (four tilters, and one stationary).

17-46. Size Variation in Checker Brick and Its Effect on Openhearth Checker Life. J. A. Pierce. *Proceedings, National Open Hearth Committee, Iron and Steel Division, American Institute of Mining and Metallurgical Engineers,* v. 30, 1947, p. 225-229; discussion, p. 229-230.

Difficulties caused by variations in dimensions of bricks obtained from the same and from different manufacturers. Recommends that the manufacturers try to achieve a more closely standardized product.

17-47. Mixer Linings. *Proceedings, National Open Hearth Committee, Iron and Steel Division, American Institute of Mining and Metallurgical Engineers,* v. 30, 1947, p. 230-233.

John Hazel, J. P. L. McMahon, and K. D. Bartels describe their experiences with different materials and designs of metal mixers.

17-48. Recent Developments in Refractories. H. M. Kraner. *Iron and Steel Engineer,* v. 25, April 1948, p. 59-64; discussion, p. 64.

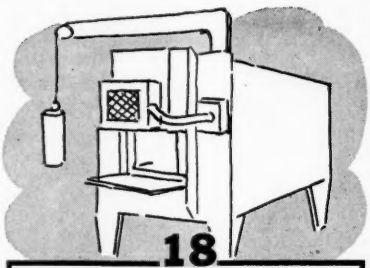
Trends are toward greater use of carbon hearths in blast furnaces, superduty brick, basic-end furnaces, and openhearth bottoms of magnesite brick with a layer of sintered magnesite on top. (Presented at A.I.S.E. Buffalo District Section Meeting, Jan. 14, 1947.)

17-49. The Openhearth Furnace—Making the Most of Silica Roofs. J. H. Chesters. *Iron Age,* v. 161, April 29, 1948, p. 72-77; May 6, 1948, p. 86-93.

Methods for improving performance of silica bricks. Causes and prevention of spalling. Various furnace construction and operation features and their effect on roof life.

For additional annotations indexed in other sections, see:

2b-100; 5a-26; 14b-66.



18 HEAT TREATMENT

18a—General

18a-7. Ferrotherm Plant Specializes in Bright Hardening, Annealing and Brazing: Part II. *Industrial Heating,* v. 15, April 1948, p. 675-676, 678, 680, 682.

Facilities of the Ferrotherm Co. in two plants, in Cleveland and in Pittsburgh, respectively.

18a-8. Standardized Rings for Semi-automatic Hardening of Gears and Similar Parts. *Machinery Lloyd* (Overseas Edition), v. 20, April 10, 1948, p. 99-100.

Equipment.

18a-9. Results of Research in Controlled Vacuum Heat Treating. Jack Huebler. *Industrial and Engineering Chemistry,* v. 40, May 1948, p. 825-831.

Effects of H_2, N_2, O_2 in steel on such heat treating operations as annealing, malleableizing, and carburizing were demonstrated. The influence of these gases on Be-Cu valve springs. Procedures required to obtain improvements in the physical properties of steels while undergoing the various heat treating operations. Significant improvement is obtained by vacuum heat treatment for malleableizing compared with treatment with the usual prepared atmospheres. Similarly significant improvement in the fatigue life of the Be-Cu valve springs is also obtainable. Equation by which the carbon gradient after any diffusion treatment may be predicted.

18a-10. Heat-Treating Principles and Their Application to Salt Baths. Haig Solakian. *American Machinist.* v. 92, April 8, 1948, p. 96-98; April 22, 1948, p. 90-93; May 6, 1948, p. 118-121.

18b—Ferrous

18b-56. Utilization and Recrystallization and Grain-Size Enlargement for Improvement of Quality of Transformer Steels. (In Russian.) F. P. Rybalko and M. V. Yakutovich. *Zhurnal Tekhnicheskoi Fiziki* (Journal of Technical Physics), v. 17, Dec. 1947, p. 1503-1512.

A laboratory method for thermomechanical treatment of transformer steel. This easily applicable method makes possible production of a large-grain crystalline structure and thus cuts power losses of the material about in half. 15 ref.

18b-57. Laws of Grain Growth of Carbides During Isothermal Tempering. Part I. Grain Growth During Tempering of Carbon Steel. (In Russian.) S. Z. Bokshtein. *Zhurnal Tekhnicheskoi Fiziki* (Journal of Technical Physics), v. 17, Dec. 1947, p. 1513-1520.

By means of static methods of microanalysis, a quantitative evaluation of the process of grain growth of the carbide phase in plain-carbon steel during isothermal tempering was obtained. This phenomenon consists of the continuous decrease of the number of small carbide particles and formation of large ones. This process is quite intensive during the first stage of tempering, but decreases quite markedly with the time. 12 ref.

18b-58. Whiteheart Malleable; A Review of Recent Developments in Industrial Gaseous Annealing. (Concluded.) P. F. Hancock. *Iron and Steel,* v. 21, April 1948, p. 141-144.

18b-59. An Evaluation of Quenching Oils by Means of the End Quench Test. C. A. Siebert and G. Sandoz. *Metals Technology,* v. 15, April 1948, T. P. 2353, 6 pages.

Data on the hardening power of five different oils representing three sources of supply. The end-quench test was used to evaluate the quenching power of the oils. Little, if any, advantage was found for use of a proprietary compounded oil in place of a straight mineral oil.

18b-60. Delayed Quench for Steel Castings. S. L. Gertsman. *American Foundrymen's Association, Preprint* No. 48-2, 1948, 9 pages.

A "delayed quench" process for heat treatment of castings involves austenitizing at temperatures usually employed, a timed cooling from the austenitizing temperature to a temperature somewhat above AR_3 and a quench in water, followed by a draw to produce required mechanical properties. Cracking susceptibility is lessened and a considerable saving of furnace time is achieved.

18b-61. Effect of Manganese-Sulphur Ratio on the Rate of Anneal of Black-Heart Malleable Iron. J. E. Rehder. *American Foundrymen's Association, Preprint* No. 48-30, 1948, 11 pages; discussion, p. 8-11.

Two series of test bars containing 0.09 and 0.21% S, respectively, were cast in which the Mn content was varied. Minimum first and second-stage isothermal annealing times were determined for each bar, and the results plotted vs. Mn-S ratio. Optimum Mn content is given by the formula % Mn = (1.7 x %S) + 0.15.

18b-62. Gray Iron Hardenability and Its Relation to Air Quenching of Castings. R. A. Flinn and R. J. Ely. *American Foundrymen's Association, Preprint* No. 48-35, 1948, 8 pages.

The range of hardenability available in unalloyed and Ni-Mo gray iron, and the use of hardenability values in planning the quenching of castings. Gray iron follows with good reproducibility the same relationships found in steels even at retarded cooling rates. Hardening of castings by air quenching to minimize distortion and cracking is correlated with these hardenability values and the surface-to-volume ratio of the casting. Spot hardening by flame and induction heating followed by air cooling is also correlated with the data. 10 ref.

18b-63. Conventional Vs. Salt Bath Hardening of Cast Iron Cylinder Liners. G. M. Lahr. *American Foundrymen's Association, Preprint* No. 48-42, 1948, 6 pages.

Compares two salt-bath heat-treating methods with the conventional quench-and-draw treatment. Advantages of the salt-bath methods.

18b-64. The Mechanical Properties of a Nickel - Chromium - Molybdenum Steel Obtained by Stepped Quenching. G. Delbart and R. Potaszkin. *Engineer's Digest* (American Edition), v. 5, March-April 1948, p. 120-124.

Previously abstracted from *Journal of the Iron and Steel Institute,* v. 157, Dec. 1947, p. 527-535. See item 18b-10, 1948.

(Turn to page 48)

Los Angeles Hears From President Foley

Left to Right at Los Angeles Chapter's President's Night Are: Edgar Brooker, Chapter Chairman; Francis B. Foley, National President; Ben Morey, Technical Chairman; and Fred J. Robbins, Past Chairman

Reported by Edgar Brooker
U. S. Spring & Bumper Co.

National President's Night was the usual big event of the Los Angeles Chapter year with President Francis B. Foley and Secretary Bill Eisenman as honored guests on March 9, 1948.

The executive committee and several past chairmen had lunch with the two national officers for discussion of society activities including the National Metals Handbook, an Educational Transcription Program, and the 1949 Western Metal Congress scheduled for Los Angeles next spring.

In the evening a good turnout assembled to hear Bill's latest stories, following which President Foley discussed "Alloys for High-Temperature Service." Ben Morey of the International Nickel Co. was technical chairman for the meeting.

Starts Manufacturers Agency

D. L. Wertz has established a manufacturers agency in Detroit covering the State of Michigan and the city of Toledo, representing the Upton Furnace Division of Commerce Pattern Co. of Detroit (manufacturers of salt bath heat treating furnaces), the John Ek Industries and the Crown Chemical Co. of Guilford, Conn. (manufacturers of heat treating salts and molten bath automatic handling equipment).

Cowles Builds New Plant

Cowles Detergent Co., Cleveland, has completed a new million-dollar plant at Skaneateles Falls, N. Y. One of the most modern chemical plants in the country, it is equipped for the manufacture, packaging and shipping of the Cowles line of heavy chemical detergent silicates and other industrial detergents.

Steel Production per Capita Gives Index To Standard of Living

Reported by E. W. Husemann
Copperweld Steel Co.

"Steel and the World We Live In" was the topic chosen by Charles M. Parker, secretary, committee on manufacturing problems, American Iron and Steel Institute, for presentation before the Warren Chapter on April 8. Mr. Parker traced the history of iron from its use by the ancient peoples through the establishment of the first ironworks in America in Saugus, Mass., in 1643 to the present-day industry.

The steel industry in America has grown from this original plant consisting of a blast furnace, bloomery, forge and machine shop with a total investment of $31,777 (at the current rate of exchange for the British pound) to the industrial giant of today capitalized at $4.83 billion and a capacity of 94,233,640 tons of ingots.

The quantity of steel produced per capita can be used as an index of the general standard of living, Mr. Parker said. A comparison of wages and purchasing power of American steelworkers with those of other countries gives substantial evidence of the high standard of living enjoyed by the peoples of this nation.

Mr. Parker also listed many of the items made from steel in the everyday world in which we live — machines, tools, instruments and accessories which man uses on, under and above the earth to enable him to accomplish more with least effort.

The talk was followed by a lively question period during which the Marshall Plan and some of its effects on the steel industry were discussed.

Metallographer's View Of Heat Treatment of Aluminum Presented

Reported by George F. Kappelt
Metallurgist, Bell Aircraft Corp.

The metallographer's view of the heat treatment of aluminum alloys was presented at the April meeting of the Buffalo Chapter A.S.M. by F. Keller, chief of metallography division, Aluminum Research Laboratories.

According to Mr. Keller, the advent of the electron microscope has furthered the investigation of age hardenable aluminum alloys. $CuAl_2$ and AlCuMg are still the important precipitation hardening constituents in 24S aluminum alloy, but precipitation hardening alone cannot account for the increase in strength obtained. Apparently considerable strengthening of the matrix results from these constituents remaining dissolved; this solid solution matrix is strengthened by precipitation of particles of the critical size and distribution.

Mr. Keller reviewed the metallurgy and micro constituents of the new high-strength alloys, such as 75S. He also made a few remarks about polishing, pointing out that magnesium oxide is still one of the most satisfactory materials for polishing aluminum specimens.

Only one brand of magnesium oxide polishes satisfactorily at the present time, he warned. Some brands are much too coarse and will cause deep scratches; others are too fine and do not cut satisfactorily. The source of supply and information as to type of this oxide will be gladly furnished by Mr. Keller upon request.

Represent A.S.M. at Centenary

The centennial anniversary of the foundation of the Societe des Ingenieurs Civils de France was celebrated in that country the week of May 29 to June 5. To represent the American Society for Metals as delegates at this event, President Foley has appointed Phillip M. Reinartz, of Armco Corp. in Paris, and Paul G. Bastien, the well-known French metallurgist.

Atomic Energy Fellowships

The National Research Council has announced a new program of fellowships supported by funds provided by the Atomic Energy Commission. These fellowships will be awarded in many fields of science related to research in atomic energy. Further information may be secured from the Fellowship Office, National Research Council, 2101 Constitution Ave., Washington 25, D. C.

See Inside Back Cover for Metal Show Hotel Reservations

18b-65. Modified Martempering. Wilhelm Olson and Gerald Nevins. *Industrial Gas,* v. 26, April 1948, p. 10-11, 16, 18-19.

Use for hardening of intricately shaped dies without serious warpage or distortion. While some of these dies are made from air-hardening, high-C, high-Cr, shock-resistant steel, the greater majority are made of Mn-Cr-W oil-hardening steel.

18b-66. Steel Heat Treating Processes and Equipment. S. D. Smoke. *Materials & Methods,* v. 27, April 1948, p. 93-104.

A reference manual containing information and data on basic methods and principal types of equipment.

18b-67. Stress-Relief Treatment of Iron Castings. *Foundry Trade Journal,* v. 84, April 1, 1948, p. 325-328; April 8, 1948, p. 351-352.

Summarizes discussion of Report of T.S.17 Committee, Institute of British Foundrymen (March 25 issue.)

18b-68. A Cause of Poor Annealability of a Commercial Malleable Iron. J. E. Rehder. *Canadian Metals and Metallurgical Industries,* v. 11, April 1948, p. 20-21, 42.

The trouble was found to be caused by the presence of Sn, Pb, and Sb which probably were introduced as a piece of babbitt or other white metal, as a sleeve or bearing in a piece of scrap iron.

18b-69. Avoiding Die Losses Due to Faulty Heat Treatment Technique. Victor Evans. *Canadian Metals and Metallurgical Industries,* v. 11, April 1948, p. 22, 36.

Ten reasons why oil-hardened dies may crack during the hardening process.

18b-70. Selective Hardening of Wear Surfaces. J. F. Libsch and R. D. Guess. *Tool Engineer,* v. 20, May 1948, p. 31-32.

How high-frequency heating provides the right heat at the right place to provide maximum strength and surface hardness in small steel parts subjected to frictional contact.

18b-71. Carbonitriding—A Casehardening Process. Edward C. Bayer and M. R. Larson. *Steel Processing,* v. 34, May 1948, p. 264-267, 272.

Process and equipment. Photomicrographs and charts showing %C vs. distance from surface for various percentages of N_2 at the surface.

18b-72. Subzero Treatments for Carburized Medium-Alloy Parts. J. C. Selby and E. S. Rowland. *Metal Progress,* v. 53, May 1948, p. 667-671.

Effects of various subzero treatments on hardness, microstructure, and size change were studied for seven common alloy carburizing steels in the single quenched condition: S.A.E. 2512, 4620, 4820, 8620, 4320, 3310, and Krupp. It was concluded that significant increases in hardness can be obtained by subzero treatment of alloy carburizing steels quenched from the pot; that choice of temperature depends on the steel, the hardness desired, and costs involved; and that the product of subzero treatment is no better and is the same as that obtained by double quenching. Deep freezing, however, seems to have advantages where minimum distortion is of paramount importance.

18b-73. Hardenability Control for Alloy Steel Parts. A. L. Boegehold. *Metal Progress,* v. 53, May 1948, p. 697-709.

An extensive illustrated discussion of the use of hardenability bands and the tentative hardenability specifications set up by S.A.E. and A.I.S.I.

18c—Nonferrous

18c-4. Continuous Annealing of Soft Drawn Copper Wire. Leonard O. Walde. *Wire and Wire Products,* v. 23, May 1948, p. 391-393, 425.

Patented process and equipment developed by Cook Engineering Co. and used by Collyer Insulated Wire Co. for annealing copper wire in conjunction with the wire-drawing operation.

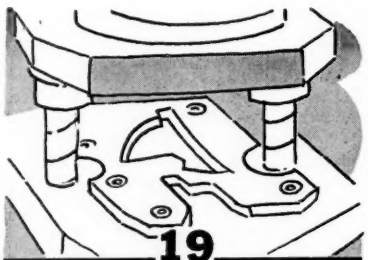
18d—Light Metals

18d-4. Step Aging of a Magnesium-Base Casting Alloy. E. J. Vargo and G. Sachs. *American Foundrymen's Association, Preprint* No. 48-3, 1948, 7 pages.

The tensile strength of the Mg-base alloy AZ63 in the solution heat treated and aged condition was commercially found to be slightly lower than that in the solution-heat treated condition, in contrast to Specification AN-M-36. This discrepancy is explained on the basis of the stress-strain curves for the two conditions and the fact that commercial quality is slightly inferior to that obtainable in the laboratory. Properties of test bars were determined after aging at various temperatures and also after "step aging", first at 250 and then at 350 or 400° F. Strength and elongation can be raised for a given aging time and aging time can be reduced significantly for a given combination of properties by replacing regular aging with step aging.

For additional annotations indexed in other sections, see:

3b-60; 4c-28; 16a-40; 19b-67.



19 WORKING

19a—General

19a-81. Some Problems in Rolling. H. Ford. *Iron and Steel Institute, Special Report* No. 39, "Reports of the Affiliated Local Societies", Dec. 1947, p. 7-27.

Orowan's theory of the deformation process in relation to previous theories and concepts and to experimental rolling tests. Results for aluminum and for steel show that, for cold rolling, the simple theory of Ekelund gives values of roll force which agree very closely with those obtained by Orowan's theory, while both can be made to agree reasonably well with experimental values under certain conditions. In hot rolling, there is insufficient experimental evidence from which to draw definite conclusions, but the new theory is believed definitely superior to old ones. (Presented at a meeting of Swansea and District Metallurgical Society, Swansea, England, Feb. 23, 1946.)

19a-82 Some Notes on Rolling-Mill Practice. G. Foster. *Iron and Steel Institute, Special Report* No. 39, "Reports of the Affiliated Local Societies", Dec. 1947, p. 49-58.

Principles of the rolling of shaped sections. The stages in an ingot's journey through a section-rolling mill. Abnormalities in the heating of ingots, together with their effect on cogging-mill practice. Difficulties encountered in the production of blooms. Principles used in the production of some of the more common structural shapes, and various methods for producing the same shape. Advantages and disadvantages of two different methods for producing joists.

19a-83. Expansion of Press Equipment Speeds Stamping Output at Active Tool & Mfg. Co. Plants. P. D. Aird. *Modern Industrial Press,* v. 10, April 1948, p. 13-14, 16, 20, 24, 36.

19a-84. Designing of "Trouble-Free" Dies. Part LXXX. Computing Press Capacities and Blanking Pressures. C. W. Hinman. *Modern Industrial Press,* v. 10, April 1948, p. 26.

19a-85. G. G. Greene Mfg. Corp. Expands in Metal Stamping Field. Walter Rudolph. *Modern Industrial Press,* v. 10, April 1948, p. 38, 40.

Procedures and equipment in production of a varied line of household stampings.

19a-86. Efficient Press Department Produces New Strato Ships, Howard E. Jackson. *Modern Industrial Press,* v. 10, April 1948, p. 46, 48, 50.

Pressing operations and equipment for production of Boeing planes.

19a-87. Strain Measurements in Deep Drawing. K. L. Jackson. *Sheet Metal Industries,* v. 25, April 1948, p. 723-724.

A method for evaluation of blank profiles of almost any shape, which does not require a knowledge of the intricacies of plastic deformation. This is done by attaching photogrids directly to the unformed blank.

19a-88. Development of Residual Stresses in Strip Rolling. R. McC. Baker, R. E. Ricksecker, and W. M. Baldwin, Jr. *Metals Technology,* v. 15, April 1948, T. P. 2333, 18 pages.

Residual stresses in rolled strip, expressed as a fraction of yield strength, are directly proportional to the square of the ratio of strip thicknesses to contact length between the roll and strip. This relationship appears to be unaffected by the magnitude of reduction per pass. Results have been extended to such practical rolling problems as firecrackering and alligatoring. 15 ref.

19a-89. How and When to Swage. Anderson Ashburn. *American Machinist,* v. 92, April 22, 1948, p. 77-84.

A special report. Advantages and limitations, and current practice.

19a-90. The Effect of Friction on the Change of Shape of Forgings. I. Y. Tarnovsky. *Engineers' Digest* (American Edition), v. 5, March-April 1948, p. 142-144. Translated and condensed from *Vestnik Inzhenerov i Tehnikov* (Bulletin of Engineering and Technology), no. 9-10, 1946, p. 291-295.

A theoretical, mathematical development.

19a-91. How to Get the Most Out of Punch Presses. Part III. Efficient Use of Material. Part IV. Piercing and Blanking Methods. Part V. Die Design. Part VI. Details of Die Design. (Concluded.) E. H. Girardot. *American Machinist,* v. 92, March 25, 1948, p. 108-111; April 8, 1948, p. 116-119; April 22, 1948, p. 86-89; May 6, 1948, p. 114-117.

In Part III numerous diagrams

(Turn to page 50)

CORROSION OF METALS

A Symposium by 5 Authors

An excellent text on the many problems of corrosion, this book provides many clues to the solutions of the varied difficulties that arise in the use of metals. Based on the successful educational course at the recent National Metal Congress, the book deals with the basic principles of metal corrosion and with problems encountered in steels, nickel-base alloys, copper-base alloys, and light alloys. Each contributor is well qualified . . . resulting in an exceptionally well balanced book covering a wide range of theoretical and practical subject matter.

192 pages, 70 illustrations, 6 x 9, red cloth binding $3.00

Published by

AMERICAN SOCIETY for METALS

7301 Euclid Ave., Cleveland 3, O.

JUST PUBLISHED

AN INTRODUCTION TO THE

ELECTRON THEORY OF METALS

BY

G. V. RAYNOR, M.A., D.Phil.

Research Fellow in Theoretical Metallurgy, Birmingham University

Bound in cloth 98 pages, with 62 figs.

7s. 6d., post free

Specially commissioned by the Institute of Metals, this book has been written for the older metallurgist whose knowledge of pure physics is insufficient to enable him to come readily to terms with the modern theoretical work on the metallic state. ● The author deals with the new approach to metallurgy, some basic principles of atomic theory, the Bohr theory of the atom, the probability conceptions, applications to metals, the effect of crystal structure, application to alloy structures, approximations involved in the results of the electron theories, insulators and conductors, magnetic properties of metals and alloys, and the cohesion of metals.

This book should be read by every metallurgist.

INSTITUTE OF METALS

4, Grosvenor Gardens, LONDON, S.W.1, England

See the New...Faster TROXIDE I-N A-C-T-I-O-N

Stop in and see us. Learn why manufacturers and platers make these reports about TROXIDE Pickling Solutions . . .

COMMERCIAL PLATING PLANT

TROXIDE outlasts muriatic acid . . . reduces frequent dumpings and rechargings of acid solutions . . . lowers maintenance and costs . . . increases safety.

REFRIGERATOR MANUFACTURER

TROXIDE outlasts sulphuric in pickling sheet steel before porcelain enameling . . . provides better working conditions . . . eliminates acid fumes from plant and burning furnaces.

BOAT MANUFACTURER

TROXIDE produces superior finish in pickling hot rolled plate for bonderizing and painting structural parts for boats . . . eliminates acid mist and corrosion of auxiliary equipment.

AUTOMOTIVE MANUFACTURER

TROXIDE outlasts muriatic by 9 to 1 on electrogalvanizing . . . in fully automatic equipment . . . practically eliminates neutralizing and dumping problems.

TROXIDE is a highly efficient pickling agent. It is non-inflammable, non-explosive and eliminates the hazards ordinarily encountered in shipping, storing, handling and mixing dangerous acids. TROXIDE does away with acid mist or spray which impairs health and corrodes metal shop equipment.

and text show principles of economical part design for various typical parts. In Part IV, the advantages and disadvantages of various piercing and blanking methods are discussed and clarified by diagrams. Part V discusses design principles. Numerous diagrams. Part VI shows standard designs for die details not previously covered.

19a-92. Hydraulic Stretch Forming Machine. *Sheet Metal Industries,* v. 25, April 1948, p. 766-767.

Machine used in the U. S. for fabrication of jet aircraft components.

19a-93. Induction Heating for Steel Forging Can Reduce Costs. Kenneth Rose. *Materials & Methods,* v. 27, April 1948, p. 76-80.

Production advantages and disadvantages. How to reduce costs and increase efficiency.

19a-94. Factors in the Operation of a Mannesmann Piercing Mill. H. R. McLaren. *Iron and Steel Engineer,* v. 25, April 1948, p. 73-77; discussion, p. 78-81.

(Presented at A.I.S.E. Annual Convention, Pittsburgh, Sept. 22, 1947.)

19a-95. Wales Sheet Metal Fabricator for Punching, Nibbling, Forming, Notching, Bending, Blanking. *Tool & Die Journal,* v. 14, May 1948, p. 98-100.

19a-96. Auxiliary Equipment for Cold Roll-Forming. E. J. Vanderploeg. *Machinery,* v. 54, May 1948, p. 170-173.

Operation of cutoff machines, rotary slitting machines, and tube-welding mills.

19a-97. Note on a New Method for Checking the Profile of Wire-Drawing Dies. J. G. Wistreich. *Journal of the Iron and Steel Institute,* v. 158, April 1948, p. 496.

Results of tests with the dental compound Zelex which show that it is very suitable for checking die shapes to production standards, since it reproduces the shape reasonably accurately and since the technique is extremely simple.

19a-98. The Rolling of Metals. Theory and Experiment—Part XVI. A Survey of Present Knowledge and the Direction of Future Research. (Concluded.) L. R. Underwood. *Sheet Metal Industries,* v. 25, April 1948, p. 704-706, 716; May 1948, p. 917-921.

Lateral spread of the material; friction between the rolls and the material rolled; roll flattening; and experimental mills. Some information on instruments used in rolling-mill research and control, and for measurement of the various forces and other factors involved.

19a-99. Practical Problems of Light Presswork Production. (Continued.) J. A. Grainger. *Sheet Metal Industries,* v. 25, April 1948, p. 719-722.

External and internal beading and curling; square flanging on the lathe; and setting the trimming and beading lathe. (To be continued.)

19a-100. Wire Drawing Problems—Drawing Solutions and Die Life. *Industrial Diamond Review,* v. 8, April 1948, p. 101-102.

Tests made on different solutions and suggestions on improving die life.

19a-101. Compound Blanking and Forming Die. *Machinery* (London), v. 72, April 15, 1948, p. 481-482.

19a-102. Mechanism for Operating Dial Feed and Radially Positioned Multiple Punches. C. F. Smith. *Machinery* (London), v. 72, April 15, 1948, p. 482-484.

19a-103. Wire Drawing. H. Richards. *Machinery* (London), v. 72, April 22, 1948, p. 510-514.

Various aspects in production of wire such as die design, die life, use of diamond dies, die lubrication and coatings. Wire-drawing practice.

19b—Ferrous

19b-58. Back-Pull Wire Drawing. A Critical Review of Literature—Part II. J. G. Wistreich. *Wire Industry,* v. 15, April 1948, p. 253-255.

Previously abstracted from *Journal of the Iron and Steel Institute,* v. 157, Nov. 1947, p. 417-428. See item 19a-1, 1948.

19b-59. Reed Roller Bit Co. Streamlines Forging Department. Gerald E. Stedman. *Modern Industrial Press,* v. 10, April 1948, p. 28, 30, 34.

19b-60. Sheet and Tin-Plate Mills; Measurement of Roll Camber. J. H. Mort. *Iron and Steel,* v. 21, April 1948, p. 111-115.

Methods used during roll dressing. (To be concluded.)

19b-61. Bending a Forging in an Arbor Press. *Machinery* (London), v. 72, April 8, 1948, p. 454.

Method diagrammed.

19b-62. Plastic Deformation of Carbon Steels. Richard Saxton. *Metallurgia,* v. 37, April 1948, p. 293-294.

The more important factors involved in the cold working of carbon steels in wire or bar form.

19b-63. Forging Die Design; Locked Dies. John Mueller. *Steel Processing,* v. 34, May 1948, p. 242-244.

Typical designs.

19b-64. Statistical Analysis for Quality Control of Forgings. Part II. E. W. Mace. *Steel Processing,* v. 34, May 1948, p. 248-250, 258.

Application to a steel thrust washer, about 3 in. diameter and 5/16 in thick, made on a horizontal forging machine.

19b-65. Modern Trends in Hot Forging Operations. C. W. Hinman. *Steel Processing,* v. 34, May 1948, p. 256-258.

Presses built by National Machinery Co., and typical parts produced on such machines.

19b-66. Mass Production Techniques on Short Run Operations. F. W. Rueblinger. *Production Engineering & Management,* v. 21, May 1948, p. 53-55.

Use of Wiedemann turret punch presses for fabrication of electrical control-equipment panels and cabinets.

19b-67. Oldsmobile Organizes Bumper Bracket Setup. *Automotive Industries,* v. 98, May 15, 1948, p. 29.

Fabrication of hot formed and heat treated secondary bumper bars.

19c—Nonferrous

19c-13. Application of Heat to Swaged Tungsten Permits Parts to Be Machined. Dan White and J. J. Aust, Jr. *Materials & Methods,* v. 27, April 1948, p. 81.

Parts are heated by an oxy-acetylene torch positioned on a lathe. Head stock of lathe is cooled by air during operation.

19d—Light Metals

19d-21. La Déformation a Chaud des Métaux a la Presse et au Marteau-Pilon. I.—Forgeage de l'Aluminium et de ses Alliages. (Hot Deformation of Metals by Presses and Hydraulic Forging Hammers. I. Forging of Aluminum and Its Alloys.) Marcellin Chartron. *Revue de l'Aluminium,* v. 25, Feb. 1948, p. 37-43.

Types of aluminum and its alloys which may be forged. Methods of forging and installations.

19d-22. Forming Aluminum for New Type Dwellings. W. J. Granberg. *Sheet Metal Worker,* v. 39, April 1948, p. 55-56.

19d-23. Stretch-Forming Aluminum. *Western Machinery and Steel World,* v. 39, April 1948, p. 97; **Hydraulic Stretch Forming Machine.** *Sheet Metal Industries,* v. 25, April 1948, p. 766-767.

New North American Aviation machine obtained for stretch-forming. It is adaptable to many jobs previously done by drophammers and other stretching and forming machines.

19d-24. Selecting Aluminum for Drawing and Forming Operations. *Reynolds Metals Technical Advisor,* v. 1, no. 7, 1948, p. 1-2.

19d-25. Tangent Bender Forms Camera Body Parts. *Iron Age,* v. 161, April 29, 1948, p. 94.

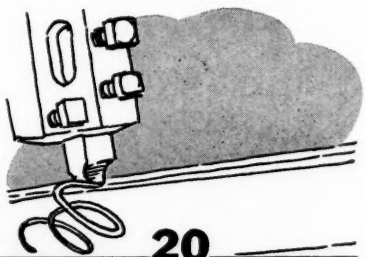
Use in manufacture of aluminum and aluminum alloy camera housings. The benders perform operations which are impractical by ordinary punch-press methods.

19d-26. Deep-Drawing One-Piece Aluminum Boat Hulls. *Machinery,* v. 54, May 1948, p. 174-176.

How Al-drawn shapes, believed to be the largest ever produced, are being formed from flat blanks in a single stroke.

For additional annotations indexed in other sections, see:

3b-71; 20a-198.



20

MACHINING and MACHINABILITY

20a—General

20a-182. Machining Cylinder Blocks for the New Austin Car. *Machinery* (London), v. 72, April 1, 1948, p. 419-427.

Method and equipment used by British firm.

20a-183. Broach-Tap Cuts Quintuple Threads. Harry S. Wharen. *American Machinist,* v. 92, April 22, 1948, p. 69-72.

High-helix quintuple thread requires tricky design of combination broach-taps that are pushed through the work in hydraulic broaching machines.

20a-184. Drilling Kinks Cut Machine Downtime. Chester S. Ricker. *American Machinist,* v. 92, April 22, 1948, p. 94.

Modification of torque wrench to record in oz-ft. for easy setting of torque controls on drilling heads of multiple-head machines; and quick change of drills for blind holes that must be held to accurate depth by presetting of drill in an intermediate insert fitting between the drill spindle and the drill.

20a-185. Practical Ideas. *American Machinist,* v. 92, April 22, 1948, p. 95-100.

Turning parts too large for lathe on the milling machine, by Frederick C. Lurz; fixture for wheel dresser for accurate radius and arc cuts, by Allen B. Nixon; positioning block to locate four equally spaced keyways on bar stock, by J. J. Kocinski; universal fixture to hold work at odd angles, by F. Scriber; fixture

(Turn to page 52)

Significant Improvements in Toolsteels Shown in Compositions, Treatments

Reported by A. M. Bounds
Chief Metallurgist, Superior Tube Co.

Since there are more bad new ideas than good ones—according to George A. Roberts, chief metallurgist, Vanadium-Alloys Steel Co., who addressed the Philadelphia Chapter A.S.M. on "A New Look at Toolsteel"—the really significant improvements in toolsteel compositions and treatments, the speaker said, can be boiled down to 10 or 15.

Turning to die steels for cold working, Dr. Roberts described a group of new compositions—namely, the manganese air hardening nondeforming steels. While interest in subzero treatment seems to have cooled a bit, nevertheless such treatment is undoubtedly beneficial in promoting the transformation of austenite in air cooled 5% chromium die steels and in high-carbon, high-chromium steels, and the practice probably will be continued.

For hot or cold working dies use of graphitic steels is a new development; another improvement is the addition of silver or lead to steel to decrease the cost of machining. One type of precipitation hardening in hot work die steel has been introduced, depending upon additions of copper, aluminum and nickel to create a precipitation hardening phase. Molybdenum alpha irons are also useful for hot working purposes. The object of this development was to raise the transformation temperature of the steel above the surface temperature attained by the die in service, since surface cracking of hot working dies is often traced to repeated transformation of the surface layers of steel.

Because steels of the 12% chromium, 12% tungsten type show critical temperatures in excess of 1750° F., these also are proving useful in hot working applications. The benefits of vanadium are not to be overlooked; in 5% chromium die steels it imparts additional hot hardness in the temperature range 1000 to 1200° F. with benefit to the life of the die, particularly in aluminum die-casting work. The optimum amount was shown to be about 0.50%.

There is such a variety of "high speed steels" that this type is described by its response to heat treatment rather than by its composition. A composition improvement is the addition of boron, which requires an attendant lowering of the carbon content. Benefits are thought to derive from the formation of hard borides.

Larger amounts of vanadium than traditionally used in high speed steel increase the amount of vanadium carbide, which microhardness tests show to be harder than either tungsten carbide or aluminum oxide.

George A. Roberts, Chief Metallurgist of Vanadium-Alloys Steel Co., Addressing the Philadelphia Chapter

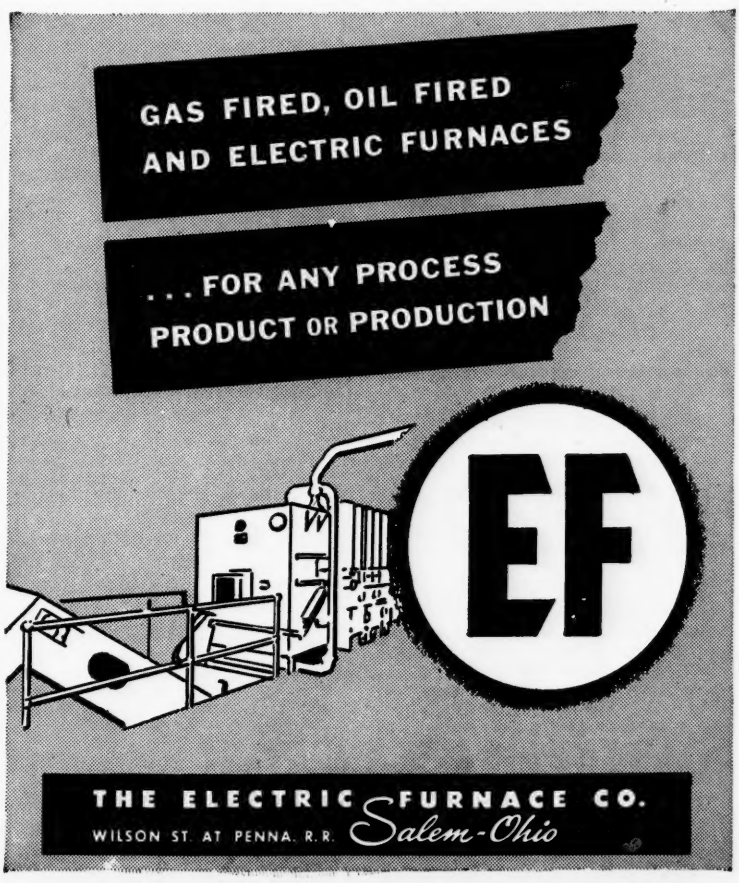
A new treatment of high speed steel consists of quenching into salt in order to form bainite instead of martensite, thus improving toughness. Also, there has been a return to the old pack hardening methods for shearing tools which must have high edge strength.

Dr. Roberts concluded his review by describing a simple bending test for high speed steel. Fairly exact calculations of fiber stress can be made with this test, and it has proved useful in evaluating the effects of tempering temperature and time, as well as hardening temperature, upon the properties of the tools.

Promoted by Columbia Steel

Joseph A. Burgard, a past chairman of the Los Angeles Chapter A.S.M., has been appointed technical sales representative for the general sales department of Columbia Steel Co. He has been affiliated with Columbia since 1929 in the southern division.

After graduating from Christian Brothers Business College, Portland, Ore., Mr. Burgard studied metallurgy while working for the Best Steel Castings Co., Oakland, Calif., where he became chief metallurgist and chemist. He later joined Enterprise Foundry Co., and then went with Columbia Steel Co. He is also acting as an instructor in fundamentals of foundry practice and operation at the University of California in Los Angeles.



mounted on bench drill to test flat springs, by Fred Lettino; making rectangular hole in block using only common machine tools, by Fredrico Strasser; V-block guides punch and drill for shaft layout and machining, by George Holman; improved vise for thin stock, by Clifford T. Bower; slotted strap adjusts punch-press feed stop both horizontally and vertically, by Burnett Menkin; accurate multiple threads cut by use of vernier on compound rest, by Everett Odell; and other miscellaneous shop hints.

20a-186 Methods of Work Clamping. *American Machinist,* v. 92, April 22, 1948, p. 107, 109, 111.

Methods for typical jobs.

20a-187. Air-Brake Clamping Jigs Speed Machining of Bus Parts. Walter Rudolph. *Steel,* v. 122, April 26, 1948, p. 109-110.

And other production aids.

20a-188. Calculating the Cams for Automatic Lathes With Movable Headstock. André Daetwyler. *Microtecnic,* v. 2, Feb. 1948, p. 21-32. Translated from the French.

Series of examples with a thorough analysis of each operation.

20a-189. The Calculation of the Most Favorable Working Conditions for Chip Producing Machining Operations. J. Witthoff. *Engineers' Digest* (American Edition), v. 5, March-April 1948, p. 109-114. Translated and condensed from *Werkstatt und Betrieb,* v. 80, April 1947, p. 77-84.

Derives equations and presents nomographs. Both cost and technological factors are considered.

20a-190. Thread Cutting in the Lathe. Part II. Carl Thomas. *Power Generation,* v. 52, April 1948, p. 76-78.

Exact procedure involved in thread cutting.

20a-191. Workshop Hints and Tips. *Machinery Lloyd* (Overseas Edition), v. 20, April 10, 1948, p. 85-87.

Milling splines; hobbing threads; tapping light metals; broaching; grinding; gear cutting; making gear hobs and master racks.

20a-192. Sound Tool Engineering Pays Dividends. Robert S. Potter. *Machinery,* v. 54, May 1948, p. 147-154.

Unusual setups on multiple-spindle chucking, precision boring, lapping, and drilling machines used in producing door-closer components.

20a-193. Cams—Their Production and Application. John E. Hyler. *Machine and Tool Blue Book,* v. 44, May 1948, p. 155-158, 160, 162, 164-166, 168.

Final installment of five-part series.

20a-194. Clearance Is Important! John E. Hyler. *Modern Machine Shop,* v. 20, May 1948, p. 124-128, 130, 132.

Modern tools and gages designed to simplify the task of obtaining correct clearance angles in grinding tools.

20a-195. Tooling and Production of the Apex Fold-A-Matic Ironer. Part IV. Carl F. Benner. *Tool & Die Journal,* v. 14, May 1948, p. 58-62, 64, 96-97.

Continuing description of machining and tooling operations on the gear case. Rough core drilling; spot face checking; milling inside boss; inside boss checking fixture; and front face drilling and reaming operations. (To be continued.)

20a-196. Optics Aid Work Location. Robert Hutcheson. *Tool & Die Journal,* v. 14, May 1948, p. 72-74, 85.

British development of the use of the toolmaker's microscope to facilitate the location of work for accurate machining.

20a-197. Ideas From Readers. *Modern Machine Shop,* v. 20, May 1948, p. 192, 194, 196, 198, 200, 202.

Shaping Machine Chip Trays, Clifford T. Bower; Measuring Tape for Draftsman's T-Square, A. H. Waychoff; Formulas for Grinding Cutter Clearance Angles, L. Kasper; Form Turning Attachment, Robert Mawson.

20a-198. Practical Ideas. *American Machinist,* v. 92, May 6, 1948, p. 123-128.

Includes the following: slotter forms threadlike cuts as crank positions unusual job, by C. D. MacKinnon; contour-grinding work fed by bar-and-cam mechanism, by Harry R. Ball; microswitch cuts off drill press when lever hits button, by Donald P. Campbell; pin stop locates and ejects stock with spring-loaded mechanism in press work, by Chris Soreson; motor brushes finished by milling-and-lapping fixture, by Edward Lay; inside threads gaged with thread-chasing fixture, N. J. Elby; punch design reduces stresses for blanking and perforating, by Frederico Strasser; drill press setup for grinding radii on cutting tools and toolbits, by Harry Stern; boring bar cuts internal sphere with link-driven rotating tool, by A. Wagner; use of motor-driven attachment to make drill press automatic, by Joseph F. Budnick; and other miscellaneous shop hints.

20a-199. Damped Quill Stops Self-Excited Chatter, E. J. Tangerman. *American Machinist,* v. 92, May 6, 1948, p. 93-95.

Weight damper applicable to quills and boring bars. It avoids outboard supports, permits blind-hole boring without chatter problems.

20a-200. Machining Motor Car Engine Components. *Machinery* (London), v. 72, April 15, 1948, p. 475-480.

Methods employed in production of the new Austin car.

20a-201. The Manufacture of Austin Brake Drums and Other Parts. *Machinery* (London), v. 72, April 22, 1948, p. 503-509.

Methods employed.

20a-202. Modified Geneva Drive for Hi-Speed Machines. Paul H. Winter. *Tool Engineer,* v 20, May 1948, p. 23-24.

Use of old principle to provide uniform motion and shockless acceleration.

20a-203. The Tool Engineer's Industrial Exposition in Review. A. E. Rylander. *Tool Engineer,* v. 20, May 1948, p. 35-43.

20a-204. Work Holding Fixtures for Production Broaching. *Production Engineering & Management,* v. 21, May 1948, p. 56-59.

(To be continued.)

20a-205. Recommended Procedure for Grinding Circular Form Tools. Charles L. Hall. *Production Engineering & Management,* v. 21, May 1948, p. 60.

Use of formula given simplifies the procedure for setting up circular form tools perpendicular to the machine table, and for grinding to a specified rake angle.

20a-206. Fixture for Offsetting. Elbridge R. Holmes. *Production Engineering & Management,* v. 21, May 1948, p. 75.

When it is desired to form an offset in a number of pieces of light weight sheet metal or flat bar stock, and the number of parts required does not justify making an elaborate fixture, a fairly uniform offset in all of the pieces can be obtained by using the method shown in the accompanying sketch.

20a-207. Vertical Slide Performs Grooving Operations. G. A. Hunt. *Screw Machine Engineering,* v. 9, May 1948, p. 41, 44-46.

Application in the production of two grooves spaced 2⅛ in. apart on a part 5 7/16 in. long.

20a-208. Pitfalls in Tooling the Screw Machine. Part II. Noel Brindle. *Screw Machine Engineering,* v. 9, May 1948, p. 47-51.

Four very important and often overlooked tooling fundamentals: reduce cut-off feed when producing a radius on cut-off end of part; use of swing or turret type stop; turning instead of forming for tubing to prevent workhardening; and points on drilling or turning beyond standard length capacity.

20a-209. Stock Ends. *Screw Machine Engineering,* v. 9, May 1948, p. 59.

Combination Turret Stop and Support, by Charles Heinz; Drill Stop, by George Schrader; and Burring Parts, by Charles Heinz.

20b—Ferrous

20b-37. 12-Foot Pit as Tooling Help. *Western Machinery and Steel World,* v. 39, April 1948, p. 81.

Use in manufacture of stainless-steel rocket motors.

20b-38. Surface Broaching Cylinder Block Castings. *Machinery* (London), v. 72, April 8, 1948, p. 447-454.

Special machines at British firm.

20b-39. Crosley Motor's New Cobra Engine Is Made of Steel Stampings, Copper Hydrogen Brazed Together. H. E. Brazier. *Machine and Tool Blue Book,* v. 44, May 1948, p. 133-138.

Parts are copper hydrogen-brazed at 150 spots. A minimum of machining operations are used. However, machining operations are stressed in this article.

20b-40. Hydraulic Honing Device for Aero Engine Production. *Industrial Diamond Review,* v. 8, April 1948, p. 116-117.

20b-41. Drill Grinding. Harold C. Reading. *Aircraft Production,* v. 10, May 1948, p. 172-174.

Pointers on obtaining greater efficiency, use of drill gage for checking angularity of the cutting edges and centrality of the point.

20b-42. Making the Dynaflow—An Exacting Precision Job. Joseph Geschelin. *Automotive Industries,* v. 98, May 15, 1948, p. 26-28, 88, 91.

Production of new Buick transmission. A sampling of the many metal-cutting operations involved.

20c—Nonferrous

20c-2. Machining Copper and Its Alloys. Joseph J. McGuinness. *American Machinist,* v. 92, May 6, 1948, p. 101-112.

Latest available data on machining the commonly used Cu and Cu-base alloys. Machinability ratings, tool shapes, specific recommendations, typical applications, corrosion resistance, and similar information based on current practice of major fabricators and suppliers.

20d—Light Metals

20d-9. Couplings From 'Automatics. *Western Machinery and Steel World,* v. 39, April 1948, p. 78-80.

Production of patented 17 S-T aluminum couplings for water, gas, steam, fluid, or hydraulic lines. Machining operations.

NEW ENGLAND CARBIDE TOOL CO., INC.
Manufacturers of Precision Carbide Products
Cambridge 39 Massachusetts

For additional annotations indexed in other sections, see:

14b-48; 27a-67-75.

(Turn to page 54)

Gradiation Heating by Gas-Air Combustion Speeds Heat Treat

Reported by Albert I. Blank
Research Dept., Chase Brass & Copper Co.

Recent developments in high-speed heating and heat treating of ferrous and nonferrous products by gas-air combustion were described by Charles A. Turner, Jr., metallurgist, Selas Corp. of America, at the March 18th meeting of the New Haven Chapter A.S.M. in Waterbury, Conn. The method, termed "Gradiation Heating", uses ceramic burners for high-temperature gradients and heat of radiant character.

Annealing and heat treating have become a part of the production line, Mr. Turner pointed out, and annealing bottlenecks can no longer be tolerated. This has created a great demand for continuous, high-speed heating which has been met in part by oxy-acetylene and induction heating. More recently the gas industry has made a considerable contribution to rapid industrial heating. Gas-air combustion provides an intense heat source which can be applied directly to the work with localization of heat in any desired area.

The heating method entails the burning of a mixture of gas and air from a premix combustion system in specially designed ceramic burners which utilize the radiant energy of incandescent surfaces to accelerate combustion with a minimum space. In one type, the heat is provided by high-velocity, hot products of combustion directed through narrow slot openings. In another type, the major heat release is provided by the direct radiation from the incandescent burner surface. Temperatures up to 3000° F. are obtained.

Either natural gas, manufactured gas or propane can be used as fuels. A great deal of flexibility for heating different types of work is provided by the combustion controller and the variety of available burners.

Gradiation heating utilizes relatively low-cost equipment compared with other heating methods. Precise control and uniformity of heating insure proper hardening and minimize distortion. Case thickness is readily controlled. The combustion controller provides a means of regulating atmosphere about the work so that free oxygen may be eliminated. Depth of decarburization is lower than in furnace heating because of this atmospheric protection and also because of the shorter heating time.

Forging slugs are uniformly heated by Gradiation heating so that the metal flows uniformly, thus reducing scrap losses. Scaling is negligible and die life is thereby increased.

Flexibility in the arrangement of burners is particularly advantageous in brazing parts of different mass. The heat can readily be varied so that all parts reach the proper brazing temperature simultaneously. Fuel cost is lower than in conventional furnaces because of greater efficiency. Confinement of heat in the relatively small, compact units makes for better working conditions.

Mr. Turner described several typical installations of Gradiation heating systems, including forging, hardening, annealing and brazing applications. In heating strip, rod or tube the metal is continuously fed through one or more heating units by an appropriate conveyor system. The metal is quenched by ring sprays as it emerges from the heating units. In annealing stainless steel rod, scaling is reduced to a thin oxide film which is easily removed in a pickling solution.

An installation for annealing tubes up to 6 in. diameter has a capacity of 60,000 lb. per hr. The temperature of the tube is measured automatically at various stages between 12 separate heating units in line, and the heat of each succeeding unit is then automatically regulated to provide precise temperature control of the work. In multiple unit installations one or more of the units can be utilized for holding at temperature, although ordinarily long soaking periods are not necessary. The small heating units permit great flexibility for a variety of work with regard to both kind and quantity.

Railway Wheel Expert Utilizes Practical Experience to Reap Benefits From Mistakes

Reported by F. R. Anderson
Chief Metallurgist, Gardner-Denver Co.

The practical approach to solution of operating problems was dramatically described by Charles B. Bryant in his talks before the Rocky Mountain Chapter at its April meetings in both Denver and Pueblo.

In his previous capacities as materials engineer for the Maryland State Roads Commission and as assistant to vice-president in charge of research and tests for the Southern Railway System, and in his present position as chief engineer of the Wrought Steel Wheel Industry, Mr. Bryant has a limitless fund of experience from which he drew in presenting the "down-to-earth" aspects of railway metallurgical problems. "Observation of practical results is just as important as laboratory tests," he stated in introducing his subject.

Failures are usually due to one or more of the following: (a) improper selection of material, (b) consequential damage, or (c) poor design. By use of slides, Mr. Bryant demonstrated a large number of failures and explained their causes.

His practical approach to seemingly baffling problems was simple, straightforward and entertaining. His persistent war against such things as sharp corners, injudiciously located stamping, and nicks, early earned him the nickname of "stress-raiser" Bryant.

Heat checks in wheels and rail are a function of rate of heating and cooling, and carbon content. Steels of lower carbon content are more resistant to checking than those of high carbon. The volume changes associated with martensite transformation determine cracking propensity.

The tremendous increase in energy to be dissipated in braking the modern train to a stop has taxed the improvements in wheel and track to the point that the incidence of failure has scarcely been changed. Figures prove, however, that modern wrought wheels are transmitting twice the braking energy volumes than the wheel of 15 years ago.

The same restraint of failure occurrence has been shown in track by special testing methods for periodically locating rail defects. While the incidence of track failure per year has remained at a fairly constant level, traffic volume, wheel loads and trackage have greatly increased. The net effect is progress.

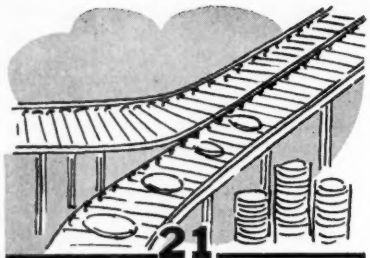
Mr. Bryant answered questions for a good half-hour after conclusion of his talk. These brought out many discussions somewhat apart from railway problems but nonetheless of relation to his general subject of "Reaping Benefits From Mistakes".

Help for French Students

University students in France are among the most sadly undernourished of all groups. Many of them are quite unable, with the present currency inflation and meager rations, to obtain sufficient food.

The American Friends Service Committee of the Quaker Church is seeking the modest sum of $10,000 to reinforce the existing canteen system at universities in direst need, where students—the leaders of France of tomorrow—can get one cheap but hearty meal daily.

Contributors can feel certain that their donations will be administered effectively. If you wish to help, mail your check to the American Friends Service Committee, 20 South 12th St., Philadelphia, Pa.



21 MISCELLANEOUS FABRICATION

21a—General

21a-70. Money Is Their Product; the U. S. Mint at San Francisco. Ralph G. Paul. *Western Machinery and Steel World,* v. 39, April 1948, p. 66-69, 94-96.

Some of the methods used which include melting, casting, rolling, press operations and annealing.

21a-71. Chevrolet; Los Angeles. *Western Machinery and Steel World,* v. 39, April 1948, p. 70-73, 102.

Miscellaneous procedures and equipment of new assembly plant.

21a-72. Bolts and Nuts Are Moving West. *Western Machinery and Steel World,* v. 39, April 1948, p. 86-88.

Facilities in Los Angeles plant.

21a-73. Engineering the Tin Can. H. S. Van Vleet. *Mechanical Engineering,* v. 70, April 1948, p. 315-320.

Engineering phases of canmaking; corrosion resistance; and steps taken toward conservation of tin. 14 ref.

21a-74. Arc Welding; Manufacture of Plant and Electrodes. *Metal Industry,* v. 72, April 9, 1948, p. 289-290.

Production of metallic arc electrodes from rolled rod.

21a-75. Smaller Valves Using Drop Forged Components Accommodate Higher Temperatures and Pressures. Dan Reebel. *Steel,* v. 122, April 26, 1948, p. 104-107.

Metalworking techniques, combined to form a completely integrated operation in production of steel iron, and bronze valves up to and including 600-lb. units. Casting, forging, machining, finishing, and inspection.

21a-76. Planned Assembly; Methods Employed on Master Cylinders for Lockheed Hydraulic Brakes. *Automobile Engineer,* v. 38, April 1948, p. 134-136.

21a-77. Green Core Handling Simplified by Special Rack and Truck. *Iron Age,* v. 161, April 29, 1948, p. 90.

Transportation of large batches of green cores from coremaker to bake ovens has been simplified by use of a specially built, shelved rack.

21a-78. Mobile Handling for Pipe. *Flow,* v. 3, May 1948, p. 34-37.

Advantages in using self-propelled yard cranes with traveling bridge cranes.

21a-79. At Sargent's Mechanized Foundry All Operators Meet the Trains. *Flow,* v. 3, May 1948, p. 44-48, 74-78.

Conveyer method whereby 50% more castings can be produced with the same floor space and with no increase in manhours.

21a-80. Massey-Harris' New Setup for Tractor Production. Joseph Geshelin. *Automotive Industries,* v. 98, May 1, 1948, p. 24-26, 62.

21a-81. Automatic Assembly Jumps Output 47 Times. Paul Bonness. *American Machinist,* v. 92, May 6, 1948, p. 96-97.

Hopper feed of rollers to final station of progressive die eliminates hand assembly and increases output of latch assemblies for Square D electrical control units from 32 to 1500 per hr.

21a-82. Conveyerization Increases Steadily in Metalworking Plants. *Steel,* v. 122, May 10, 1948, p. 104, 107.

Results of survey of 2000 metalworking establishments.

21b—Ferrous

21b-38. Mass Producing Heavy Containers. *Western Machinery and Steel World,* v. 39, April 1948, p. 74-77, 100-101, 109.

Procedures and equipment used in producing 55-gal. petroleum and general utility drums, 5-gal. industrial paint pails, and 110-lb. grease drums. Operations include shaping, seaming, welding, testing, and finishing.

21b-39. Rapid Processing of Automobile Door Hinges. John A. Broden. *Iron Age,* v. 161, April 29, 1948, p. 86-90.

High-speed production methods for automobile door hinges, involving punching, drilling, broaching, and countersinking, as well as assembly and materials handling.

21b-40. Futuramic Bodies Require Major Change-Over. *Automotive Industries,* v. 98, May 1, 1948, p. 42-44.

Production equipment and methods.

21b-41. Diverse Assembly Methods Used to Build New Type Welder. Jay DeEulis. *Steel,* v. 122, May 10, 1948, p. 96-100.

21c—Nonferrous

21c-6. Radiator Output Increased 50% by Mechanized Processing. *Steel,* v. 122, May 3, 1948, p. 94-97.

Fully conveyorized line for building automobile radiators which is expected to save an estimated 10 man-minutes per unit on assembly operations and to reduce damage to fins. Operations include forming, cutting and trimming, soldering, tempering, assembly, and finishing.

For additional annotations indexed in other sections, see: 7b-79; 27a-68.

22 JOINING and FLAME CUTTING

22a—General

22a-103. Inert-Gas Shielded-Arc Welding. (Concluded.) *Sheet Metal Worker,* v. 39, April 1948, p. 66-68.

Setting the welding current, selecting electrodes, joint design, proper jigging, use of back-ups, and making the weld.

22a-104. The Processing of Aluminum-Steel Bonded Assemblies. M. G. Whitfield and B. Sheshunoff. *Modern Metals,* v. 4, April 1948, p. 13-15.

Some applications, methods of processing, design factors, necesary equipment, heat treatment, as well as brazing these metals.

22a-105. Local Elastic and Plastic Deformation During the Welding of Rods Onto Sheets. (In Russian.) N. N. Prokhorov, N. V. Shiganov, and A. V. Mordvinsteva. *Avtogenno Delo* (Welding), Feb. 1948, p. 12-15.

Results of investigations show that deformation often takes place in cooling, resulting in cracks. The rate and amount of this deformation increases with increased plate width. Proposes cooling the zone adjacent to the weld by means of water.

22a-106. Resistance Welding in Mass Production; Butt and Flash-Butt Welders. A. J. Hipperson and T. Watson. *Welding,* v. 16, April 1948, p. 145-151, 162.

Different types and their operation. Control of the variables affecting quality.

22a-107. The Comparative Performance of Air-Supplied Welding Helmets. Merril Eisenbud and Leslie Silverman. *Welding Journal,* v. 27, April 1948, p. 287-289.

The performance characteristics of three types of supplied-air welding helmets were studied. The plenum method of supplying air provided a protective efficiency of over 99% as compared to a maximum of 73% for the next best design. The plenum helmet was likewise more satisfactory because of lower operating pressure and less noise.

22a-108. New Applications of Inert-Arc Welding. R. W. Tuthill. *Welding Journal,* v. 27, April 1948, p. 299-301.

(Presented at 28th Annual Meeting, A.W.S., Chicago, week of Oct. 19, 1947.)

22a-109. Maintenance of Resistance Welding Equipment. F. R. Woodward. *Welding Journal,* v. 27, April 1948, p. 301-303.

Recommendations based on experience. (Presented at meeting of Detroit Section of A.W.S., Jan. 9, 1948.)

22a-110. Periodic Inspection and Preventive Maintenance of Arc-Welding Equipment. Volney H. Speck. *Welding Journal,* v. 27, April 1948, p. 303-304.

Maintenance and care of a.c. and d.c., single-operator, arc welding units of the 150, 200, 300, 400, and 600-amp. types. (Presented at meeting of Detroit Section A.W.S., Jan. 9, 1948.)

22a-111. Seam Weld Attachments for Spot Welders of the Rocker Arm Type. W. S. Horth. *Welding Journal,* v. 27, April 1948, p. 305-306.

22a-112. Explosive Rivets; Recent Developments in American Automobile Construction. H. C. Hendrick. *Automobile Engineer,* v. 38, April 1948, p. 141-142.

22a-113. Preloaded Bolt Betters Design. *SAE Journal,* v. 56, April 1948, p. 20-22. Based on "Applications, Materials, and Specifications of Bolts", by W. C. Stewart.

Preloading a bolt and maintaining that tension throughout the life of the joined part helps the bolt perform its clamping function better and makes it last longer. (This paper will be published in full in *SAE Quarterly Transactions).*

22a-114. Why, Where, How You Can Use Multi-Torch Stack Cutting. *Industry and Welding,* v. 21, May 1948, p. 40-42, 44, 46.

22a-115. Bonding Rubber to Die Castings. John Gerstenmaier. *Die Castings* v. 6, May 1948 p. 25-26, 51.

Standard procedures.

(Turn to page 56)

Cites Need for Further Work on Continuous Cooling

Reported by Warren F. Savage
Rensselaer Polytechnic Institute

The problem of devising a simple means to analyze the many variables involved in the heat treatment of hollow steel propeller blades was the incentive which promoted interest in continuous cooling transformation work on the part of C. A. Liedholm, he told members of the Eastern New York Chapter A.S.M. on March 9.

Mr. Liedholm, who is now quality manager for the Piasecki Helicopter Corp., described these investigations at the Propeller Division of Curtiss-Wright Corp., where he was formerly chief engineering metallurgist.

Continuous cooling diagrams, prepared by combining Jominy end-quench test data and Bain's method of arresting transformations by quenching, were shown and discussed. Impact and fatigue test specimens were prepared from flat end-quench specimens to correlate the properties with observed microstructures. Experimental data were presented for partially transformed and slack quenched structures in hypo-eutectoid steels of high pearlite and bainite hardenabilities.

Mr. Liedholm pointed out that rejections of ferrite during continuous cooling prior to isothermal transformation may have a profound effect on the time required to complete the isothermal transformation to bainite. Sometimes this will increase the time required by more than 2000%, making such isothermal transformations impractical as a means of avoiding formation of martensite.

In closing, Mr. Liedholm emphasized the need for further work in this field and the value of such work to the steel heat treating industry.

New Ejector Tool Slide Film

A new slide film entitled "Advantages and Economies of Ejector-Type Tools With Carbide Inserts" has been completed by Super Tool Co., 21650 Hoover Rd., Detroit. The film is available for showing before any group, such as technical societies or tool departments, who make requests to Super Tool Co. If desired, an engineer with projection equipment will also be sent to make the presentation and conduct the question and answer period.

Evolution of Copper Alloys Illustrated by Movie

Reported by Walter H. Clemons
National Bearings Division

A lecture on "The Uses and Properties of Bronzes and Copper Alloys", presented by Oscar Frohman, consulting engineer, Ampco Metals, Inc., before the March 25th meeting of the Northwest Pennsylvania Chapter A.S.M., was supplemented by a new industrial film depicting the "History and Development of Copper-Base Alloys".

Mr. Frohman told how prehistoric man hammered weapons from copper. Probably one of the first alloys known to man was the tin-copper combination. He described the evolution of the bronzes and brasses down to the present time, and explained the differences between them as of today.

He discussed the properties and uses of special alloys such as aluminum, manganese and beryllium bronzes, showing that these alloys, along with other bronzes, have a definite place in the world of tomorrow. The evolution of different methods of casting was described. Centrifugal and continuous casting have a definite place in the bronze industry, Mr. Frohman pointed out.

HERE'S HOW . . .

To get copies of articles annotated in the A.S.M. Review of Current Metal Literature

Two alternative methods are:

1. Write to the original source of the article asking for tear sheets, a reprint or a copy of the issue in which it appeared. A new list of addresses of the periodicals annotated is now on the press and will be available on request.

2. Order photostatic copies from the New York Public Library, New York City, or from the Engineering Societies Library, 29 West 39th St., New York 18, N. Y. A nominal charge is made, varying with the length of the article and page size of the periodical.

Write to Metals Review for free copy of the address list

METALS REVIEW

7301 Euclid Ave. **Cleveland 3, Ohio**

CHEMICALS ACP PROCESSES

SURFACE TREATING CHEMICALS

PROTECT METALS

There are ACP Chemicals that—

- *Remove rust, oil, grease and other surface soil.*
- *Provide a bond for firm and durable finish adhesion.*
- *Prevent rust during storage and transit.*
- *Inhibit pickling acids and improve complete pickling operations.*

Send for Bulletin P-100-21 on ACP surface-treating chemicals, and metal protective service. Dept. Met-1.

AMERICAN CHEMICAL PAINT CO.
AMBLER, PENNSYLVANIA

22b—Ferrous

22b-135. "Shucks, We'll Do It Right Here!" Frank Tucker. *Weld,* v. 4, April 1948, p. 6-7.

Difficult welding-repair job on sections of 30-in. cast-iron pipe. It consisted of cutting a large oval section out of a cement-lined pipe 1-in. thick and welding a 1½ x 2-in. steel flange between the bell section and the neck of the pipe.

22b-136. Waldrip Builds Shell Rig for Swift Travel and Erection in 24 Min. —All-Welded Construction Does It! *Weld,* v. 4, April 1948, p. 14-15.

New portable rig built for Shell Oil Co.

22b-137. Techniques of Quality Welding of Plain Carbon Steel Castings. E. LaGrelius and J. D. Wozny. *American Foundrymen's Association, Preprint No.* 48-8, 1948, 10 pages.

Object was to develop superior welding techniques for plain-carbon steel castings and to determine the metallurgical effects of size of weld, section size welded, and subsequent heat treatments on hardness and microstructure. It was found that mineral or lime-coated electrodes generally produce sound welds free from pinhole porosity. Electrodes were developed whose deposits met the minimum required physical properties of plain-carbon steel castings.

22b-138. Results of Conference on Automatic Welding Under Flux, Kiev, October 3-6, 1947. (In Russian.) E. O. Patona. *Avtogennoe Delo* (Welding) Jan. 1948, p. 1-21.

New methods developed in the U.S.S.R. and abroad, especially those adaptable to large-sized jobs. Production of fluxes from blast-furnace slags is recommended. Future research goals.

22b-139. The Sulphur Reaction and Hot Cracking During Automatic Welding of Low-Carbon Steel Under Flux. (In Russian.) K. V. Lynbavskii. *Avtogennoe Delo* (Welding), Jan. 1948, p. 22-26.

Results of investigation, show that hot cracking depends not only upon sulphur concentration but on the form in which it is present. MnS or a solid solution rich in MnS is said to be less harmful than iron sulphides.

22b-140. Technology of Butt Welding of Steel Rings of Large Diameter and Cross Section. (In Russian.) V. I. Korovkin. *Avtogennoe Delo* (Welding), Jan. 1948, p. 27-28.

Special method and optimum conditions.

22b-141. Spot Welding of Heads to Pins. (In Russian.) B. G. Filippov. *Avtogennoe Delo* (Welding), Jan. 1948, p. 27.

Special jig.

22b-142. Control of the Tempering of Structural Steel During Welding. (In Russian.) N. N. Rykalin and L. A. Fridlyand. *Avtogennoe Delo* (Welding), Feb. 1948, p. 3-11.

Details of calculation of proper arc welding conditions (manual and automatic) for different types of joints and seams.

22b-143. Deformation of Plates of Carbon and Alloy Steels During Automatic Welding Under Flux. (In Russian.) V. M. Rybakov. *Avtogennoe Delo* (Welding), Feb. 1948, p. 15-20.

An extensive investigation of the effects of steel composition, current density, rate of welding, arc voltage, position of electrodes, and electrode composition.

22b-144. Use of a Special Heating Torch During Straightening of Welded Structures. (In Russian.) A. Ya. Brodskii. *Avtogennoe Delo* (Welding), Feb. 1948, p. 20-22.

Torch and method of its use. Mathematical calculations for the theoretical heat distribution and torch design for welding of cylindrical tubes.

22b-145. A Method for Automatic Welding of Riveted Joints Under Flux. (In Russian.) V. V. Vershinskii and V. N. Dubov. *Avtogennoe Delo* (Welding), Feb. 1948, p. 25-26.

Method and equipment.

22b-146. Production of Cutting Tools by Welding-on of a Cutting Edge Using Special Electrodes. (In Russian.) V. V. Danilevskii. *Avtogennoe Delo* (Welding), Feb. 1948, p. 26-27.

Compositions of electrode cores and coatings. (Only the qualitative composition is given for the latter.)

22b-147. Safety Precautions During Repair of Gasoline Tanks by Electric Arc Welding. (In Russian.) D. E. Bondarev and A. V. Bibikov. *Avtogennoe Delo* (Welding), Feb. 1948, p. 28-30.

22b-148. The Manufacture and Application of Composite Plates. O. R. Carpenter. *Welding Journal,* v. 27, April 1948, p. 279-287.

Previously abstracted from *Steel,* v. 121, Dec. 22, 1947, p. 64-66, 83-84. See item 22-782, R.M.L., v. 4, 1947.

22b-149. Welding in Machine Design. J. Mikulak. *Welding Journal,* v. 27, April 1948, p. 290-298.

Fundamental design factors for ferrous welding design.

22b-150. Carbon and Alloy Steels; Development of Electrodes for Welding High Tensile Steels. T. L. H. Butterfield. *Welding,* v. 16, April 1948, p. 152-156, 162.

The causes of cold cracking in alloy steels, the hydrogen-inclusion theory, and the way in which electrodes have been developed to overcome some of the difficulties encountered.

22b-151. Welded Railway Wagons; Use of High Tensile Steel. *Welding,* v. 16, April 1948, p. 171-173.

22b-152. Effect of Variables in Welding Technique on the Strength of Direct-Current Metal-Arc-Welded Joints in Aircraft Steel. Part II. Repeated-Stress Tests of Joints in S.A.E. 4130 Seamless Steel Tubing. C. B. Voldrich and E. T. Armstrong. *National Advisory Committee for Aeronautics, Technical Note No.* 1262, April 1948, 85 pages.

Tests were made on joints in S.A.E. 4130, seamless-steel tubing. Variables included type of electrode, speed of welding, current, position, amount of preheat, and other factors which in turn controlled the weld contour, penetration, and depth of the heat-affected zone. A range of joint design was also investigated. Fatigue data showed that stress concentrations due to weld geometry were the predominating factors in determining endurance life. Previous concepts relative to the behavior of fillet and butt welds were confirmed.

22b-153. Getting Ready to Weld. *Linde Tips,* v. 27, April 1948, p. 29-32.

How to prepare steel sheet or plate for welding. Hints on flame adjustment.

22b-154. How to Make Them Last. *Linde Tips,* v. 27, April 1948, p. 32-33.

Increase life of farm equipment parts by hard-facing.

22b-155. Coupling Allows Welding Pipe in Service, Saves up to 24 Hours in Repair Time. *Petroleum Processing,* v. 3, May 1948, p. 406-407.

22b-156. New Welding Techniques. Frank Charity. *Modern Machine Shop,* v. 20, May 1948, p. 146-148, 150, 152, 154.

Use of heliarc welding for stainless and carbon-steel products.

22b-157. Jigs and Fixtures Facilitate Economic Mass Welding. O. L. Duble. *Steel,* v. 122, May 3, 1948, p. 90-93.

Actual examples which show how the use of positioners and fitting and holding devices saves time and money.

22b-158. Manual Hidden Arc Welding Speeds Manufacture of Chemical and Refinery Equipment. J. L. Wolcott. *Steel,* v. 122, May 10, 1948, p. 102, 112.

22c—Nonferrous

22c-12. The Welding of Nonferrous Metals—Part XI. The Welding of Zinc and Its Alloys. (Continued.) E. G. West. *Sheet Metal Industries,* v. 25, April 1948, p. 777-781, 784.

22 references.

22d—Light Metals

22d-23. Recent Magnesium Developments. W. S. Loose. *Modern Metals,* v. 4, April 1948, p. 26-28.

Electroplating magnesium; high-frequency, superimposed, a.c., magnesium, arc welding; and brazing of magnesium.

22d-24. Examination of Light Alloy Flash Welds Made by Aseasvets, Sweden. R. F. Tylecote. *Sheet Metal Industries,* v. 25, April 1948, p. 787-790, 792.

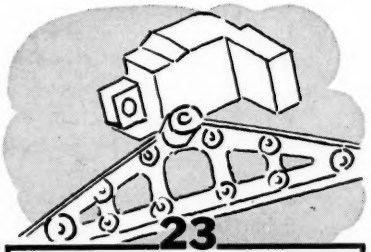
Details of a study of these welds. Tensile properties were satisfactory although elongation in some cases was not as good as usually obtained with fusion welds. (Presented at B.W.R.A. Symposium on Welding of Light Alloys.)

22d-25. Flash Butt Welding of Aluminum Alloys in Sweden. B. Anderson. *Sheet Metal Industries,* v. 25, April 1948, p. 785-786, 792.

Machine used by and opinions of the Swedish firm of "Aseasvets" regarding principles of the above. Methods, and information concerning results obtained. (Presented at B.W.R.A. Symposium on Welding of Light Alloys.)

For additional annotations indexed in other sections, see:

3b-63; **3d**-23; **12a**-54; **15b**-16-18-19-20-22-24-25-28; **18a**-7; **20b**-39; **27a**-69.



23
APPLICATIONS

23b—Ferrous

23b-27. Modern Cast Irons; Application—Properties—Manufacture. A. M. Ondreyco. *Western Machinery and Steel World,* v. 39, April 1948, p. 90-93.

Emphasizes Meehanite types.

23b-28. Roller Bearing Applications for Modern Freight Cars. M. S. Downes. *American Society of Mechanical Engineers, Paper* No. 47-A-135 (Advance Copy), 1947, 3 pages.

Applications and advantages.

23b-29. Bearing Construction With

(Turn to page 58)

Bearing Problems Characterized as "If" Engineering

Reported by Kenneth O. Uran
Production Control Manager
Columbian Enameling & Stamping Co.

Referring to the field of bearing engineering as "if" engineering, Arthur F. Underwood, addressing the Terre Haute Chapter A.S.M., concluded that no formula which is solvable can be written to cover friction as applied to bearings because of the many variables involved. Mr. Underwood is head of mechanical engineering department 5 of General Motors Research Laboratories.

Years ago it was felt that a bearing material must, of necessity, have hard particles embedded in a soft matrix. Today it is known that this is not essential at all, for pure silver makes a reasonably good bearing material and copper-lead bearings are the exact converse of this, having soft lead particles and a hard copper matrix.

Mr. Underwood traced the history of bearing developments and lubrication from the earliest research work, which was done by Professor Tower in 1876, down to the present time.

The bearing properties that are most important are score resistance, compression strength and good fatigue quality. Nearly all bearings that are subjected to alternating loads fail in fatigue in time. Today, bearings have been made which will run over 200 hr. on tests that would have caused failure in 15 hr. as little as 20 years ago. Conformability is another important property. Material should be soft enough to conform to any irregularities.

Mr. Underwood closed the meeting by showing a new film on "Fundamentals of Bearing Lubrication" or "Oil Film in Action". This film reveals for the first time in actual pictures some of the facts concerning bearing lubrication that previously were topics largely for speculation and theory.

See Inside Back Cover for Metal Show Hotel Reservations

Machinability Requires Proper Microstructure

Reported by Harold W. Schmid
General Metals Corp.

An amply illustrated talk on the relationship between microstructure and machinability was presented by A. G. Sturrock, director of research, Wyckoff Steel Co., before the May meeting of the Texas Chapter A.S.M.

Mr. Sturrock emphasized the necessity for determining the best microstructure for a particular machining application rather than depending on less accurate standards, such as hardness ranges. Because of the variables involved, extreme care should be exercised and sufficient research should be employed to ascertain the microstructure and heat treatment necessary to place the steel in the desired condition for optimum machinability.

Welding Conference Held in 4 Meetings

Reported by Henry Hauseman
Metallurgist, LaPlant Choate Mfg Co.

The second annual Conference on Welding of the Cedar Rapids Chapter A. S. M. was recently completed, with an average of 200 persons attending each of the four sessions.

Leon C. Bibber, welding engineer for Carnegie-Illinois Steel Corp., opened the conference on March 23, speaking on "The Elements of Welded Design and Construction". His talk was illustrated with a color film of the steel industry.

Richard G. Wyer, welding engineer, General Electric Co., was the second session's technical speaker. The subject for this meeting, held March 30, was "Inert-Arc Welding". Mr. Wyer discussed the newer aspects of this process and its applications, and emphasized such technical points as heat transfer from arc to work, rate of heating, and speed of travel. Comparisons between helium and argon applications were made, and recent General Electric research projects were described.

"Eutectic Low-Temperature Welding" was the subject of the third session, held April 6. R. H. Groman, welding consultant for the Eutectic Welding Alloys Corp., emphasized the value of this process for salvage and maintenance work on nonferrous metals. It is also useful for joining nonferrous to ferrous metals. In eutectic welding metals are bonded at temperatures lower than the fusion point of the metals. Connections are produced with high strength, excellent ductility and good appearance.

The final session was held April 13, and featured a lecture by D. C. Smith, chief metallurgist, Harnischfeger Corp., electrode division, on "Arc Welding Electrode Coatings and their Effect on Welding". Dr. Smith discussed briefly the history of electrode coatings and the properties of bare-wire vs. coated-wire welds. Among the newer developments in coated rods are the low-hydrogen or lime-ferritic types, and a recently developed Type 6013 electrode, which can be deposited at the rate of 60 ft. per min.

....IMPORTANT NOTICE....

TO

Welding Equipment Manufacturers

The August issue of METALS REVIEW will again consider the subject of welding in its monthly feature section. An important part of these feature sections is METALS REVIEW's unique series of product reviews—carefully edited digests of new equipment recently introduced in the field under consideration.

The subject of welding was last treated in these pages in February 1948. If you have any new welding equipment or supplies—or equipment that has been improved or redesigned during the past six months—send us a brief description and a glossy photograph.

Mark your calendar to send us the copy before June 28—or, better yet, do it right now!

Metals Review

7301 EUCLID AVENUE CLEVELAND 3, OHIO

P.S. Manufacturers of welding equipment will find this August issue a good buy. High reader interest in the field you sell will be assured. Your advertising will be placed next to editorial material and given prominent display. Make your reservation now.

Cast Iron as Anti-Friction Material. M. S. Karpyshev. *Engineers' Digest* (American Edition), v. 5, March-April 1948, p. 153. Translated and abstracted from *Vestnik Machinostroenia,* (Bulletin of the Machine Industry), v. 16, No. 11-12, 1946, p. 24-29.

Experimental results which indicate that cast-iron bearings will give satisfactory service under more severe conditions of pressure and rubbing rates, provided accurate fabrication techniques are followed.

23c—Nonferrous

23c-32. The Housing Problem. *Die Casting,* v. 6, May 1948, p. 27, 44.

Use of die castings for the housings of many small products.

23c-33. Here's a Tip. *Die Castings,* v. 6, May 1948, p. 37, 54-55.

Use of Zn die castings for small hardware specialties produced in large volume.

23c-34. Clean-Cut. V. G. Biro. *Die Castings,* v. 6, May 1948, p. 41-43.

Food-catching crevices have been eliminated in meat-and-bone cutting machine by use of die castings.

23d—Light Metals

23d-76. Alcoa Davenport Mill Big Aluminum User. *Modern Metals,* v. 4, April 1948, p. 21.

Largest single application of aluminum to date in the building trades. More than 6,250,000 lb. of aluminum is used in the construction of its nearly completed Davenport, Iowa, sheet-and-plate rolling mill.

23d-77. The Quartermaster Corps Designs for Magnesium. J. W. Millard. *Modern Metals,* v. 4, April 1948, p. 22-25.

Seven reasons why the Quartermaster Corps is interested in magnesium and typical examples of applications being developed.

23d-78. Aluminum Cans. D. Nickelsen. *Modern Packaging,* v. 21, April 1948, p. 134-137, 274, 276.

Use of the above for food packaging in Norway. Advantages and limitations, and storage life for various foods as determined by experiment. Use of surface protection to prevent corrosion is required for certain types of food.

For additional annotations indexed in other sections, see:
3b-65-72; 3d-24; 19d-24.

24a—General

24a-101. The Effective Stress Concentration at the End of a Crack in Materials Having Atomic Constitution. C. Gurney. *Philosophical Magazine,* 7th Series, v. 39, Jan. 1948, p. 71-76.

Cracks are assumed to have elliptic form and average stress over a small area at the end of the major axis of an elliptic crack is computed in terms of the ratio of the lengths of the major and minor axes of the ellipse, and of the ratio of the average length to the radius of curvature at the end of the crack.

24a-102. A New Criterion of Yielding in Metals Due to Complex Stresses. K. H. Swainger. *Philosophical Magazine,* 7th Series, v. 39, Feb. 1948, p. 122-133.

The plane-stress experimental ellipse is accepted and the equation for it is written in linear form by means of vectors. It is shown that any plane-stress system except "two-dimensional hydrostatic pressure or tension" will reduce to simple shear with simple tension or compression at any point by choosing suitable directions to define the orthogonal element on which the stresses act. Experimental results on yield-stress values then apply to the element with this orientation. Any three-dimensional stress system except hydrostatic pressure or tension can be reduced to one of simple tension or compression together with two shears at any given point by suitable choice of directions. These three stresses will define two ellipsoidal surfaces for complete specification of yielding.

24a-103. Warping and Shear Lag in Closed Cylindrical Shells. Leon Beskin. *Journal of the Aeronautical Sciences,* v. 15, April 1948, p. 221-231.

The state of stress in thin-walled closed cylindrical shells was determined in the neighborhood of sections with concentrated loads or of sections corresponding to discontinuities of section properties, such as fixed ends. A method of successive approximations was developed, using conventional beam formulas as the first approximation. The second approximation was determined and examined in some detail for cases of torsion and bending. Superposition of the two solutions gives the possibility of writing arbitrary warping conditions at given sections.

24a-104. The Analysis of a Circular Ring With Propped Floor Beam. J. S. Taylor and S. S. Gill. *Journal of the Aeronautical Sciences,* v. 15, April 1948, p. 237-242.

A method for analyzing a circular fuselage former with a floor crossbeam supported by four vertical struts.

24a-105. Internal Stresses in Metals and Alloys: Part I. *Industrial Heating,* v. 15, April 1948, p. 590, 592, 594, 596.

Summarizes papers presented at symposium conducted by the British Institute of Metals. (To be continued.)

24a-106. Die-Grams. Karl L. Bues. *Western Machinery and Steel World,* v. 39, April 1948, p. 107-108.

Design for twisting flat parts.

24a-107. The Development of Complex Patterns. A. Dickason. *Sheet Metal Industries,* v. 25, April 1948, p. 747-751.

Design and layout of several complicated sheet metal ducts and hoppers.

24a-108. Use of Sandwich Construction in Military Aircraft. Robert T. Schwartz. *Technical Data Digest,* v. 13, April 15, 1948, p. 7-12.

Construction of primary structural parts, as well as materials development projects, and determination of design criteria. "Sandwich construction" refers to any structure having relatively high-strength faces of metal or plastic, integrally bonded to a core material of low density.

24a-109. Can Castings be Engineered? F. G. Tatnall. *American Foundrymen's Association, Preprint No.* 48-45, 1948, 4 pages.

Thin-wire strain gages and strain-gage technique for analyzing strain in metal components. Brittle-lacquer technique for stress analysis in components to show where design improvements are necessary. A procedure for design improvement.

24a-110. Development and Trend in the Design of Hopper Discharge Types of Railway Cars. George A. Suckfield. *American Society of Mechanical Engineers, Paper* No. 47-A-78 (Advance Copy), 1947, 9 pages.

Weights, strengths, and other properties; costs for various metals, alloy, and wood combinations.

24a-111. The Effect of Shape and Size Factors on the Fatigue Strength. N. N. Aphanasiev. *Engineers' Digest* (American Edition), v. 5, March-April 1948, p. 132-136. Translated and condensed from "A Collection of Papers on the Dynamic Strength of Machine Parts", Institute of Practical Engineering of the Academy of Science, U.S.S.R., 1946, p. 157-167.

An analysis based on theoretical consideration and on the literature. The theory presented makes it possible to ascertain the properties of a material by a short series of fatigue tests from which further calculations can be carried out in cases where it is possible to determine the stress gradient and the theoretical stress-concentration factor. 20 ref.

24a-112. Bending of Rectangular Plates With Large Deflections. Chi-Teh Wang. *National Advisory Committee for Aeronautics, Technical Note* No. 1462, April 1948, 34 pages.

Von Karman's equations for thin plates with large deflections are solved for special cases of rectangular plates of 1.5 and 2.0 length-width ratios under uniform normal pressure. Center deflections (to twice the plate thickness), membrane stresses, and extreme-fiber bending stresses are given as functions of pressure.

24a-113. A General Small-Deflection Theory for Flat Sandwich Plates. Charles Libove and S. B. Batdorf. *National Advisory Committee for Aeronautics, Technical Note* No. 1526, April 1948. 53 pages.

Theory is developed for elastic behavior of orthotropic flat plates in which deflections due to shear are taken into account. In this theory, a plate is characterized by seven physical constants; five stiffnesses; and two Poisson ratios, of which six are independent.

24b—Ferrous

24b-58. Ferromagnetic Metals; Identification and Measurement of Internal Stresses. Part I—Magnetic Tests. (Concluded.) **Part II—Mechanical Tests.** Albert Borowik. *Iron and Steel,* v. 21, April 1948, p. 117-121.

Basic principles, equipment, sample shapes, and calculation of proper strain rates in mechanical testing. Tables and charts illustrate the calculation of internal stresses. 20 ref.

24b-59. Notes on the Design and Construction of Staybolt Locomotives. Fred D. Huston. *American Society of Mechanical Engineers, Paper* No. 47-A-59 (Advance Copy.), 1947, 17 pages.

Previously abstracted from condensed version, *Railway Mechanical Engineer,* v. 122, April 1948, p. 65-69, 80. See item 24b-55, 1948.

24b-60. Freight Car Truck Progress. Robert Boyd Cottrell. *American Society of Mechanical Engineers, Paper* No. 47-A-71 (Advance Copy), 1947, 13 pages.

(Turn to page 60)

Poor Technique and Poor Design Adversely Affect Welded Structures

Reported by J. C. Selby
Metallurgical Engineer
Timken Roller Bearing Co.

Proper design, workmanship and selection of materials can produce a sound welded structure, but slighting any one of these factors can result in trouble, Leon C. Bibber of Carnegie-Illinois Steel Corp. told the Canton-Massillon Chapter A.S.M. at its April meeting. Mr. Bibber's talk on "The Effect of Welding and Other Local Heating Processes on Residual Stress and Dimensional Changes in Steel" was not exclusively metallurgical in nature, but would have been of equal interest to any group of engineers.

He touched on the metallurgy involved in his topic briefly wherever it was necessary to explain or clarify a specific point, such as the fundamentals of the changes produced in steel by heating and cooling. He illustrated by an interesting experiment and numerous slides the problems produced when a piece of metal is heated (as in welding) and cooled in air.

The speaker then discussed briefly the uses of flame heating in straightening of warped or twisted structures, showing by slides the application of flame straightening to different sections.

Turning to the effects of various welding techniques on the residual stresses in welded structures, he showed how poor technique and poor design can adversely affect the finished product.

During the short discussion period following the talk, several members asked question on the failure of welded ships during the war, which Mr. Bibber discussed in some detail. He also answered several questions concerning specific welding problems.

Contest on Resistance Welding Ends July 31

A first prize of $750 and other prizes ranging from $200 to $500 will be awarded by the Resistance Welder Manufacturers' Association for the best papers dealing with resistance welding subjects submitted to the American Welding Society before July 31, 1948.

Three prizes will be awarded to the best papers by individuals in industry, private or government laboratories, or in consulting engineering work. There are no restrictions as to the scope of the subject matter, providing it deals specifically with resistance welding.

A first prize of $300 and a second prize of $200 will also be awarded for papers emanating from a university source—either by an instructor, a student, or a research fellow.

Full details are available from Resistance Welder Manufacturers' Association, 505 Arch St., Philadelphia, or from the American Welding Society, 33 West 39th St., New York.

Outlines Techniques For Stainless Steel Foundry Practice

Reported by J. W. Sweet
Chief Metallurgist, Boeing Aircraft Co.

"Stainless Steel Castings" were treated from the standpoints of effect of the different alloying elements and heat treatments on corrosion resistance, of casting technique, and of design problems in an interesting talk presented before the Puget Sound Chapter A. S. M. by W. B. Kirby of the Electric Steel Foundry of Portland, Ore.

The importance of chromium in developing a thin, adherent oxide film on stainless steels was emphasized. Nickel in 18-8 type stainless acts as a producer and stabilizer of austenite. Carbon tends to reduce corrosion resistance and every effort is made to keep it to a minimum. Molybdenum is added to the austenitic steels to increase their resistance to sulphite corrosion.

In order to obtain maximum corrosion resistance, according to Mr. Kirby, the chromium and other elements should be in solution. In the austenitic steel intergranular corrosion results when the material is not properly annealed or when heated in the sensitization range (approximately 800 to 1600° F.). Austenitic steels susceptible to intergranular corrosion have chromium carbides precipitated in the grain boundaries. Proper heat treatment consists in quenching the castings from approximately 2100° F. into water. This acts to dissolve the chromium carbides and retain them in solution.

Chromium is the bad actor in the foundry process, the speaker pointed out. The charge must be melted under a nonoxidizing slag so as to keep chromium in the bath. The necessary additional chromium is added at the end of the heat because of its strong tendency to oxidize. The carbon electrode of the furnace must not touch the bath else carbon pickup in the melt result. The bath is heated to approximately 3200° F., but poured at 2900° F. The pouring temperature controls the grain size of the austenitic castings.

Mr. Kirby ended his talk by emphasizing the importance of discussing design of a part with the foundry and thus arriving at a satisfactory solution for both parties involved.

New Members of Quarter-Century Club

The following A.S.M. members have been awarded honorary certificates commemorating 25 years' consecutive membership in the society:

Pittsburgh Chapter

W. P. Benter, Frank A. Bond, Y. J. Bruce, W. E. Davis, Harry W. Good, J. T. Howat, Richard D. Jordan, E. A. Lucas, A. Roy Pafenbach, R. H. Pauley, David J. Richards, Sr., C. E. Spang, Norman F. Tisdale, M. M. Townsend, United Engineering & Foundry Co. (sustaining membership), Vanadium Corp. of America (sustaining membership), Vulcan Crucible Steel Co. (sustaining membership), W. B. Wallis, E. Thomas Walton, L. J. Weber, E. C. Wright.

Chicago Chapter

E. C. Blocks, Wm. F. Bromm, F. E. Burgess, J. F. Calef, Donald L. Colwell, T. D. Hayes, H. W. Jerry, A. R. Jones, Lindberg Steel Treating Co. (sustaining membership represented by L. A. Lindberg), John B. Lukey, H. F. Moore, S. W. Parker, Garnet P. Phillips, Ivan Racheff, E. F. Ross.

New Haven Chapter

Bristol Co. (sustaining membership), Charles Doescher, Frank L. Wright.

Hartford Chapter

David J. O'Brien, John H. G. Williams.

Member-at-Large

Perry P. Mapes of Mount Hermon, Calif.

German Magnetic Alloy Reproduced in U. S.

A German magnetic alloy known as Permenorm 5000-Z has been reproduced for the first time in the United States by scientists at the Naval Ordnance Laboratory, White Oak, Md. Revolutionary changes in the rectification of electric power are expected from use of the new alloy, which will replace many of the complicated, delicate and troublesome electronic tube amplifiers employed in guided missiles and similar ordnance.

The Naval Ordnance Laboratory will hold a symposium on magnetic materials in the near future, at which the development will be described at length so that the process can be made known to industry without delay. Credit for reproduction of the alloy and its new applications goes to Gustaf W. Elmen and Edward A. Gaugler, physicists at the Naval Ordnance Laboratory.

Improvements in design and metallurgy. Mechanical-test data.

24b-61. Flexural Fatigue Strength of Steel Beams. Wilbur M. Wilson. *Engineering Experiment Station, University of Illinois, Bulletin Series No.* 377 (v. 45, No. 33), Jan. 22, 1948, 34 pages.

The principal purpose of the investigation was to determine the relative fatigue strengths of various kinds of flexural members. The fatigue tests were supplemented by static tests of similar specimens. Specimens tested included numerous combinations.

24b-62. Progress Reports of Investigation of Railroad Rails and Joint Bars. R. E. Cramer, N. J. Alleman, and R. S. Jensen. *Engineering Experiment Station, University of Illinois, Reprint Series No.* 37 (v. 44, No. 46), March 28, 1947, 47 pages. Reprinted from *American Railway Engineering Association, Bulletin*, v. 48, Feb. 1947.

24b-63. Cleavage Fracture of Ship Plates as Influenced by Size Effect. Wilbur M. Wilson, Robert A. Hechtman and Walter H. Burckner. *Welding Journal*, v. 27, April 1948, p. 200s-207s; discussion, p. 208s. Condensed from a report to Bureau of Ships, U. S. Navy.

Tests were made on ¾-in. plates with nominal widths of 72, 48, 24, and 12 in. Average static strength; energy-absorbing capacity; V-notch impact value as an indicator of performance of the wide plate test, distribution of plastic deformation at the ends of the stress raiser prior to maximum load; temperature-elongation relation; and reduction in thickness of the plates.

24d—Light Metals

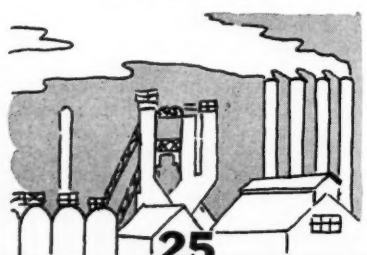
24d-17. Aluminum Alloy Castings. Floyd A. Lewis. *Foundry*, v. 76, May 1948, p. 142-145, 352-353.

Design of Al-alloy castings. Sixth of a series based on a survey sponsored by the Foundry Division of the Aluminum Association.

24d-18. Simplification of Light Metal Casting Design and Its Effect Upon Serviceability. W. T. Bean, Jr. *Transactions of the American Foundrymen's Association*, v. 55, 1947, p. 430-439; discussion, p. 440.

Application to numerous airplane parts. Use of direct strain measurement as a fundamental approach to the design problem using the brittle-lacquer technique.

For additional annotations indexed in other sections, see:
5a-29; 6a-48; 7b-75; 14a-92; 19a-91; 27a-60-63-77.



25 STATISTICS

25a—General

25a-34. Metallurgy in the Development of Atomic Power. John Chipman. *U. S. Atomic Energy Commission*, MDDC-539, Oct. 1946, 20 pages.

What can be told of the relatively small but vitally important part played by the metallurgical research units associated with that part of the atomic-bomb development which has become known as the plutonium project. Metallurgy of uranium and plutonium, and also of metals considered and used for uranium containers. (Presented to several A.S.M. chapters.)

25a-35. Scientific and Technical Research in British Industry. Federation of British Industries, 1947, 26 pages.

A statistical survey.

25a-36. Mineral Production of Canada Reaches Record Value in 1947. H. McLeod. *Canadian Mining Journal*, v. 69, Feb. 1948, p. 64-73.

Extensive statistics.

25a-37. Metallurgical Books. (Continued.) Sibyl E. Warren. *Metals Review*, v. 21, April 1948, p. 41, 43.

This section of a classified bibliography of books published during 1936 to 1946, inclusive, covers physical metallurgy in general and the structure and properties of metals and alloys. (To be continued.)

25b—Ferrous

25b-51. Peacetime Output Record Reflected in Steel Producers' 1947 Earnings. *Steel*, v. 122, April 26, 1948, insert between p. 78 and 79.

Statistical supplement includes folding table consisting of a comparative financial analysis of the steel industry (28 producers, representing 92.06% of capacity), for 1946 and 1947.

25b-52. Survey of Steel Manufacturers; Production Costs Per Net Ton of Selected Carbon Steel Products, Nine Months Ending September 30, 1944. *Office of Temporary Controls* (Washington), *OPA Economic Data Series No.* 17, May 1947, 3 pages.

25b-53. Economics of Application of High Strength Steel in Freight Cars. A. F. Stuebing. *American Society of Mechanical Engineers, Paper* No. 47-A-107 (Advance Copy.), 1947, 14 pages.

Economic analysis indicates substantial advantages for the above.

25b-54. Should the Steel Industry Expand Now? T. C. Du Mond. *Materials & Methods*, v. 27, April 1948, p. 65-67.

Problems and economic aspects.

25b-55. Texas Steel Industry—Markets. D. I. Brown. *Iron Age*, v. 161, April 29, 1948, p. 119-120, 122.

Phenomenal industrial postwar growth in Texas. Steel consumers' needs are not being given enough consideration by "Big Steel".

25b-56. Revolutionary Changes Feared in Steel Markets. *Steel*, v. 122, May 3, 1948, p. 53-55, 170.

It is believed that the Supreme Court decision in the cement case, outlawing multiple-basing-point pricing, will cause serious dislocations among steel producers and consumers if applied to industry generally.

25b-57. Texas Steel Industry—Production. D. I. Brown. *Iron Age*, v. 161, May 6, 1948, p. 119-120, 125.

Economic considerations begun in April 29 issue. ("Texas Steel Industry—Markets.")

25c—Nonferrous

25c-37. Says Procurement of Copper for Stockpiling Should Be in Hands of Single Administrator. Robert G. Page. *Metals*, v. 18, April 1948, p. 7-9.

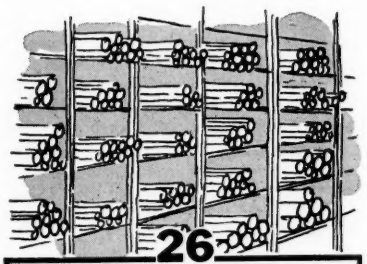
25c-38. The World Situation in Zinc. Simon D. Strauss. *Metals*, v. 18, April 1948, p. 10-12.

A discussion. (To be continued.) (Presented at 30th annual meeting American Zinc Institute, St. Louis, April 16, 1948.)

25c-39. Zinc Smelting Industry in U.S. R. A. Young. *Metals*, v. 18, April 1948, p. 13-14.

Excerpts of address delivered at 30th annual meeting of American Zinc Institute, St. Louis, April 15, 1948.

For additional annotations indexed in other sections, see:
15b-23; 27a-78.



26 MISCELLANEOUS

26a—General

26a-41. The United States Atomic Energy Commission. R. P. Johnson. *Journal of Engineering Education*, v. 38, March 1948, p. 440-445.

An address discusses research activities.

26a-42. Research in Australia. *Engineering*, v. 165, Feb. 13, 1948, p. 161-162; March 12, 1948, p. 245-246.

Research facilities and activities in diverse fields.

26a-43. Coke Oven Machinery. Ragnar Berg. *Iron and Steel Engineer*, v. 25, April 1948, p. 98-104; discussion, p. 104-105.

Constructional and functional features of machinery used in connection with operation of a battery of coke ovens. (Presented at A.I.S.E. Annual Convention, Pittsburgh, Sept. 25, 1947.)

26a-44. Materials at Work. *Materials & Methods*, v. 27, April 1948, p. 72-75.

A new department consisting of brief descriptions and illustrations of methods by which progressive engineers are taking advantage of the properties of materials—both new and old. Items are as follows: alloy tubing; cast iron welded to sheet steel; stainless-steel helicopter blades; sound-deadening metal; rhodium-plated aluminum; roughing-up castings; plastic gas pipes; and formed springs by the strip.

26a-45. The British Iron and Steel Research Association as Typified by the Battersea Laboratories. M. W. Thring. *Research*, v. 1, April 1948, p. 320-324.

A plan for the development of a physics department to serve the steel industry. Physics of metals, instrumentation, heat transfer and pyrometry, flow of gases, molten steel and molten slag, and the mathematical theory underlying these processes.

26a-46. Isotopes and Their Application to Peacetime Use of Atomic Energy. Paul Aebersold. *Bulletin of the Atomic Scientists*, v. 4, May 1948, p. 151-154.

Rapid growth in their utilization in varied fields as indicated by shipments and allocations. Distribution of use among eight broad fields of science.

26b—Ferrous

26b-20. Czechoslovakia; Postwar Iron and Steel Production. J. Jicinsky. *Iron and Steel*, v. 21, April 1948, p. 133-134. Condensed from *Hutnické Listy.*

(Turn to page 62)

books . . .

FOR *YOUR* METALLURGICAL LIBRARY

● **ACID ELECTRIC FURNACE STEEL MAKING PRACTICE**. . . by Conrad C. Wissmann

This little book is a mine of information for melters and operators of acid electric steel melting furnaces. The book presents a simple set of instructions as an aid to those engaged in steel melting work. All of the problems discussed have to do with the operation of the furnace and the process of steel making. Mr. Wissmann tells of practices used in such operations as charging the furnace, tapping temperatures, low carbon heats, etc. Photographs and charts are used freely.

81 pages . . . 5 x 7 . . . 14 illustrations . . . paper binding . . . $1.00

● **HEAT TREATMENT OF METALS**. . . a Symposium

Ten popular heat treating lectures presented before the Los Angeles chapter of the American Society for Metals create a book that brings together the latest developments in this field. This book deals with the many types of heat treatment, discusses furnaces and induction equipment, covers both ferrous and nonferrous metals and metal forms.

Fundamental metallurgy connected with heat treatment is discussed. Various heat treatments are defined and their uses explained to illustrate how heat treatment amplifies the mechanical properties for the best practical application. Lavishly illustrated with charts and photographs, well indexed for reference.

178 pages . . . 6 x 9 . . . 103 illustrations . . . red cloth binding . . . $3.00

● **ELECTRONIC METHODS OF INSPECTION**. . . a Symposium

This new book is based on a series of seven educational lectures on electronic methods of inspection presented during the 28th National Metal Congress. The book outlines some of the important developments that have resulted in the last ten years as a result of the tremendous increase in interest in strain measurements in material and structural testing. Experts in the metal industry also discuss spectrochemical analysis of metals, uses of the cyclograph for testing of metals, supersonic methods of metal inspection, determination of seams in steel by magnetic analysis equipment, the electron microscope and electronics in liquid steel. The book contains many references and a comprehensive index for ready use.

189 pages . . . 6 x 9 . . . red cloth binding . . . $3.50

● **METAL DATA SHEETS**

This is a complete collection of 150 data sheets originally published in Metal Progress. Widely used in industry, these data sheets are now available in loose-leaf form on 8½ x 11 sheets, collected in an attractive folder for file reference. Each data sheet has been revised and a cross index of the entire contents is printed on the file folder. General scope of these data sheets includes physical-metallurgical data . . . forging . . . steel—compositions, structure, hardenability . . . machinability . . . heat treatment—quenching, tempering, annealing, carburizing . . . corrosion resistant steels and alloys . . . heat resistant steels and alloys . . . nonferrous metals—copper, zinc, nickel, aluminum, magnesium . . . electroplating . . . welding.

150 pages . . . 8½ x 11 . . . $4.00

TECHNICAL BOOKS

AMERICAN SOCIETY FOR METALS

7301 EUCLID AVENUE CLEVELAND 3, OHIO

27 NEW BOOKS

27a—General

27a-59. Elementary Physical Metallurgy. Edward G. Mahin. 276 pages. 1948. Chemical Publishing Co., Inc., Brooklyn 2. N. Y.

The microscope and the preparation of metallographic specimens; fundamental properties of materials and their relationship to one another; methods of testing and interpretation of test results. Treatments of hardness, thermal analysis, pyrometry, and phase diagrams.

27a-60. Photo-Elasticity. Vol. II. Max Mark Frocht. 505 pages. 1948. John Wiley & Sons, Inc., 440 Fourth Ave., New York 16, N. Y.

A treatise on advanced principles and methods. Essential elements of the theory of elasticity; a critical examination of the influence of physical constants on state of stress in two dimensions; a survey of methods for determination of sums of principal stresses with special emphasis on the numerical solution of Laplace's equations; also theory and technique of three-dimensional photo-elasticity with applications to stress concentrations.

27a-61. Wear and Surface Finish. E. L. Hemingway. 80 pages. Gisholt Machine Co., Madison, Wis.

The measurement of surface finish, methods of finishing, the reasons for wear and its relation to desirable finish. (From review in *American Machinist,* v. 92, May 6, 1948.)

27a-62. An Introduction to the Physics of Metals and Alloys. W. Boas. 193 pages. 1947. John Wiley & Sons, Inc. 440 Fourth Ave., New York 16, N. Y. $3.50.

Properties of metals and alloys in terms of properties of atoms and how to produce a material with desired properties. Properties and arrangement of crystals determine properties of polycrystalline aggregates. Principles of X-ray analysis, properties and deformation of metals, and phase changes in alloys.

27a-63. Strength of Materials. Joseph Marin. 464 pages. 1948. MacMillan Company, New York, N. Y. $4.75.

Part I deals with stresses; mechanical properties and design of members subjected to tension, compression, transverse and torsional shear; bending; bending and axial stresses; and with columns. Part 2 deals with combined stresses and their determination. Includes theories of failure and design. Part 3 discusses statically indeterminate stresses and describes the deformation method and energy method. Part 4 considers riveted and welded joints and other special problems.

27a-64. Chemical and Electroplated Finishes; the Protective Treatment of Metals. H. Silman. 414 pages. 1948. Chapman & Hall, Ltd., 37 Essex Street, W.C. 2, London.

Finishes commercially applied to metals for decorative and protective purposes from aqueous solutions with or without use of electric current. A comprehensive account of modern industrial finishing processes, together with the chemical and physical principles involved in them.

27a-65. Plant Layout Techniques. John R. Immer. 55 pages. Buf Advertising Co., 404 W. 48th St., Minneapolis, Minnesota. $1.75.

Intended primarily for the student, this book stresses the flow of materials. Principles of assembly-line layout, progressive assembly, specialization of labor, straightline production, jigs and fixtures, flexibility, subassembly, and continuous flow of production. Emphasizes cost considerations. Flow charts and diagrams, drawings, templets, and scale models. (From review in *American Machinist,* v. 92, May 6, 1948.)

27a-66. Kinematics of Machines. Leon Marr Sahag. 249 pages. Ronald Press Co., 15 E. 26th St., New York, 10, N. Y. $4.00.

Text is divided into separate chapters, in each of which the study of motions relative to particular mechanisms is discussed in detail. The graphic method is applied to the solution of problems in velocities and accelerations. (From review in *Modern Machine Shop,* v. 20, May 1948.)

27a-67. Design of Metal Cutting Tools. Frederic L. Woodcock. 406 pages. McGraw-Hill Book Co., Inc., 330 W. 42nd St., New York 18, N. Y.

Practical application of the tool to the job, how to salvage worn-out tools and adapt them to new uses, and how tools are made to function accurately and economically. Fundamentals of design, including elements of cutting, materials, heat treatments, and fluids, and practical procedures and easy-to-follow instructions on the design of broaches, cutters, drills, hobs, punches, dies, reamers, and other tools.

27a-68. Some Basic Techniques in Materials Handling. 84 pages. Clapp & Poliak, 350 Fifth Ave., New York 1, N. Y. $1.00.

A report of the proceedings at technical sessions of the Conference on Materials Handling, Cleveland, Ohio, Jan. 1948. 19 papers are included.

27a-69. Tvrde Kovg, Obrabeni Materialu, Vyvoj Tvridych Kovu a Jejich Pouziti. (Hard Facing Materials and Their Applications.) Edition 2. Vydalo Nakladatelstvi. 274 pages. 1947. Prace v Praze, Prague, Czechoslovakia.

Hard metals for machine tools. Manual covers metal-cutting fundamentals and economic considerations, the production and use of carbides and other hard metals, and effective combinations of tool types and metals to be cut. An historical survey of the hard metals, information on shop layout, and installation of new tool types. (From review in *Mechanical Engineering,* v. 70, April 1948.)

27a-70. Siderurgie en Electrosiderurgie. (Metallurgy and Electrometallurgy.) Albert De Sy. 450 pages. 1947. N. V. Standaard Boekhandel, Antwerp, Belgium. 430 Belgian francs.

Two volumes of a series of three expanded from a manual of instruction for students in the state university in Ghent. Volume I is a text on general metallurgy and covers such topics as metallurgical operations, fuel and its application to metallurgy, metallurgical furnaces, and refractories. Processes of roasting, smelting, fuming, electric heat treatment, electrolysis, and sintering. Volume II treats the particular subject of ferrous metallurgy, and deals with such topics as pig iron, blast furnaces, and steelmaking. (From review in *Mechanical Engineering,* v. 70, April 1948.)

27a-71. Fundamental Principles and Applications of Induction Heating. 147 pages. 1947. Chapman & Hall, Ltd., London, W.C. 2, England. 10s 6d.

The development and applications of industrial heating, as well as principles of induction and coil design and choice of frequency equipment. Applications to surface hardening, internal hardening, tempering, forging, and other processes. (From review in *Mechanical Engineering,* v. 70, April 1948.)

27a-72. German Engineers' Tool Industry. C. H. Booth and others. 200 pages. 1947. The authors, Brooklyn, New York. $10.00.

Prepared by the British Intelligence Objectives Committee, this survey presents individual reports on various types of tools as well as the general report. (From review in *Mechanical Engineering,* v. 70, April 1948.)

27a-73. Symposium on Powder Metallurgy; Special Report No. 38. Edition 2 (Revised.) 208 pages. Dec. 1947. Iron and Steel Institute, 4 Grosvenor Gardens, London, S.W. 1, England.

An introductory historical note and 27 papers in the following groups: preparation, properties, and testing of metal powders; magnetic powders and products; hard metal carbides; porous-metal components; and the manufacture and properties of sintered components. Individual papers are being abstracted separately.

27a-74. S.A.E. Handbook 1947. 822 pages. 1947. Society of Automotive Engineers Inc., New York 18, N. Y. $10.00.

New material includes specifications for hydraulic brake fluids, standards for serrated shafts, nomenclature and definitions for three types of crankcase oil, standards for pipe, filler, and lubrication fittings, specifications for automotive steel castings, and general information on welding electrodes and on copper and silver brazing. Other standards and specifications have been reviewed and revised. (From review in *Foundry,* v. 76, May 1948.)

27a-75. Form Tools. William F. Walker. 301 pages. Hutchinsons Scientific & Technical Publications, 47, Princes Gate, London, S.W. 7, England. 25s net.

Flat tools, circular form tools, tangential tools, dovetail form tools, and form tools with rake. Other topics discussed are tool materials, methods of holding, design, manufacture, grinding, and the use of form tools. (From review in *Machinery* (London), v. 72, April 15, 1948.)

27a-76. Chamber's Mineralogical Dictionary. Edition 2. Chemical Publishing Company, 26 Court St., Dept. M. C., Brooklyn, N. Y. $4.75.

A popular British work beautifully illustrated with 40 colored plates. Lists over 1400 minerals, and gives chemical compositions, crystal forms, physical properties, occurrences, and uses. (From review in *Steel Processing,* v. 34, May 1948.)

27a-77. Le Formulaire des Engrenages. (A Manual for Gear Design.) Charles Macabrey. 367 pages. Dunod, 92 Rue Bonaparte, Paris 6, France. 750 francs.

Theoretical and practical requirements and many recent developments. Gear-tooth gaging and inspection methods as well as strength of gear teeth and forces called into

(Turn to page 64)

EMPLOYMENT SERVICE BUREAU

The Employment Service Bureau is operated as a service to members of the American Society for Metals and no charge is made for advertising insertions. The "Positions Wanted" column, however, is restricted to members in good standing of the A. S. M. Ads are limited to 50 words and only one insertion of any one ad. Address answers care of A.S.M., 7301 Euclid Ave., Cleveland 3, Ohio, unless otherwise stated.

POSITIONS OPEN

East

SCIENTIFIC AND TECHNICAL PERSONNEL: For Potomac River Naval Command. Chemist, engineer, physicist, mathematician and metallurgist are positions open. Salaries range from $3397 to $5902 a year. No written test. Applicants must have had college study or technical experience or a combination of such study and experience, plus professional experience in the appropriate field. Information and application forms may be secured at most first and second-class post offices, from Civil Service regional offices, or from the U. S. Civil Service Commission, Washington 25, D. C.

RESEARCH METALLURGIST: For fundamental studies in high temperature metallurgical program. Should have imagination, ability, and liking for research and development of alloys. Graduate educational background or equivalent in research endeavor essential. Salary commensurate with qualifications and experience. Box 6-105.

Midwest

WELDING ENGINEER: College graduate with stainless steel experience preferred. Must be familiar with resistance welding, inert gas welding, torch welding, brazing and soldering. To work with shop troubles concerning welding design or shop operations. Box 6-5.

POSITIONS WANTED

MECHANICAL ENGINEER: B.A., B.M.E., M.M.E., P.E. One year full time and 2½ years part time instructor in engineering college. Three years' experimental and development work in metallurgy and mechanical engineering. Some drafting and design. Desires position with future in teaching or with progressive company in industry. Location secondary. Box 6-10.

NONFERROUS METALLURGIST: Age 46, married. Doctor's degree. Excellent record in alloy and process development, fundamental research and production control. Extensive experience in copper and copper alloys, aluminum, lead, tin, white metals, zinc alloys and precious metals. Desires connection with progressive concern. Box 6-15.

MECHANICAL ENGINEER: Well versed in metal processing. Now teaching physical metallurgy and shop processes, including casting, machining, welding, and forging. Former supervisory and research experience in powder metallurgy. Prefers research or production position but will consider other fields. Age 26, married. Resumé on request. Available Sept. 1, 1948. Box 6-20.

METALLURGIST: M.S. 1948, age 29, married. Graduate work in corrosion, physical metallurgy, X-ray and physical chemistry. Three years' experience in engineering design. Was in Naval Air Corps three years. Desires position with future in development or production work. West or midwest preferred. Available Sept. 1, 1948. Box 6-25.

METALLURGIST: B.S. in metallurgical engineering, Age 29, married, veteran. Four years' experience in welding and steel castings research. For past 2½ years has been plant metallurgist for large fabricating company in Milwaukee area. Complete data on request. Box 6-30.

EXECUTIVE METALLURGIST: Metallurgical and chemical training at Sheffield University, England. Twenty-five years' experience in the United States as metallurgist and superintendent in leading steel foundries. For three years instructor in engineering school. Familiar with production methods, costs, labor relations. Box 6-40.

DUTCH METALLURGICAL ENGINEER: Is seeking employment in this country. D.Sc degree. Employed for 14 years at company engaged in fabrication of all kinds of electrical equipment, as physical metallurgist, production engineer, and head of laboratory. Several publications. Box 6-50.

MANAGEMENT AND PRODUCTION ENGINEER: Available on weekly basis. Renders service personally—no assistants. Develops improved methods and systems through cooperation and assistance of personnel affected, thus insuring workability and successful operation and increasing interest in and contentment with the job. A single idea developed during a short survey pays huge dividends. Box 6-55.

METALLURGICAL ENGINEER: Five years' experience in development, research and production control, physical and metallographic testing of materials, fabrication and heat treatment of high speed, carbon, engineering steels, cast irons and stainless steel, with emphasis on isothermal treatments. Experience in metallurgical laboratory supervision and sales promotion. Desires responsible position in metallurgical administration. Prefers the East. Box 6-60.

METALLURGIST: Age 40. Seeks executive position. M.I.T. graduate and Ph.D. Experience in engineering education, group leader in research, development and customer service laboratory. Publications on coatings, heat treating (ferrous and nonferrous) and corrosion. Speaks Spanish, French, German, and Swedish. Box 6-65.

METALLURGIST: M.S. in metallurgy. Ten years' top grade research and manufacturing experience, principally with refractory, rare and precious metals; corrosion resistant, high-temperature and nonferrous alloys; vacuum applications. Thoroughly familiar with welding and brazing processes. Desires position where engineering training, experience and resourcefulness will be fully utilized. Box 6-80.

PRODUCTION AND SALES ENGINEER: Tungsten carbide and cast alloy. Age 40. Eighteen consecutive years' experience on cutting tools, wear resisting parts, wire dies, deep drawing dies, lamination dies, extrusion dies. Capable of setting up and operating plant and engineering sales. Box 6-70.

METALLURGIST: M.S. in metallurgy. Age 30, married. Six years' experience in all phases of heat treatment. One year's experience in applied research on aluminum. Desires position in production, trouble shooting, or applied research. Available October 1948. Southern California preferred. Box 6-75.

PATENT ASSISTANT: About one year's experience preparing and prosecuting patent applications relating to metallurgy and chemistry (organic and inorganic). Desires position with corporation or law firm in New England, preferably Boston area. Metallurgical engineer, Purdue University, 1947, with honors. Veteran, age 28, married. Box 6-85.

PRODUCTION MANAGER (INDUSTRIAL): Well qualified in field having had over 20 years in automotive production with large automobile company as plant superintendent and factory manager. Experienced in plant layouts, time studies and mass production methods. Cost and quality minded. Available immediately. Will relocate. Married. Reliable. Box 6-90.

METALLURGICAL ENGINEER: Graduating in August 1948 from University of Illinois with B.S. in metallurgical engineering. Age 25, single, veteran. Three years' service. Honor student. Desires position in research and development or production work. Box 6-95.

SERVICE AND SALES ENGINEER: Age 30. Four years' industrial experience and three years' selling experience in ferrous field. Good basic knowledge of alloy, stainless and toolsteels; heat treatment and fabrication. Desires sales or service position with steel producer or fabricator. Location immaterial. Box 6-100.

METALLURGIST — METALLOGRAPHIST: Inquiries invited. Fully trained and experienced for position in production, quality control, development and research. Abilities and personality especially adapted to the multiple requirements of a small or medium sized company. Age 36. Present employment as assistant to chief metallurgist. Box 6-110.

METALLURGICAL SALES ENGINEER OR HEAT TREAT SUPERINTENDENT: Twelve years' diversified experience in ferrous metallurgy in supervisory capacity in heat treating, physical testing and metallography. Consulting, trouble shooting and development. Two years' experience as metallurgical sales engineer directing toolsteel sales. Midwest preferred. B.Sc. degree, age 39, married. Box 6-115.

REPRESENTATIVE: For American ferrous or nonferrous industry or welding equipment manufacturer in Quebec and Ontario or France. Young metallurgical engineer speaking French and English. Single. Five summers' experience in industry. Good references. Box 6-120.

CONSULTANT: On strength of materials problems can supplement advanced analytical methods with laboratory facilities for full scale testing plus mobile equipment for stress and vibration measurement. Surveys made of company methods in strength of materials work. Box 6-125.

REPRESENTATIVE: Graduate electrical engineer, aged 40. Now contacting manufacturers in greater Chicago area, representing producers of metal stampings (in small lots), powdered metal parts, and molded plastics. Interested in adding several lines of noncompeting but complementary products or services on an exclusive territorial arrangement. Box 6-130.

CHEMIST—METALLURGIST: Long experience in nonferrous field, utilizing all grades of scrap and virgin metals for production of brass, bronze and lead, tin, zinc, cadmium and aluminum base alloys. Seeks additional work in consultation, analysis, research. Well equipped laboratory. Location southern New England. Box 6-135.

METALLURGICAL ENGINEER: Married. M.S. in metallurgy from Stevens Institute of Technology, June 1948. Thesis in powder metallurgy. Eight years' experience in research laboratory. Desires position in the powder metallurgy field. Eastern location preferred. Box 6-140.

METALLURGIST: Eighteen years' experience—automotive, tube mill, teaching and sales. Eight years as chief metallurgist. Interested in responsible position in metallurgical production, sales work or teaching. Box 6-45.

WIRE MILL METALLURGIST: Over 15 years experience in steel mill wire division. Broad knowledge of rod and wire inspection supervision, metallurgy and processing. Employed at present. Age 29, B.S. in chemical engineering. Box 6-35.

play by various types and systems of gearing. Types of gearing include spur, stub-toothed, straight-bevel, spiral, hypoid, Zerol, Gleason, Maag, and worm gears. An interesting chapter is concerned with elliptical and hyperboloidal gears. Other subjects touched upon include roller and silent-chain gearing. Various gear cutting, generating, and finishing methods. (From review in *Machinery* (London), v. 72, April 15, 1948.)

27a-78. Seventy-Five Years of Progress in the Mineral Industry (1871-1946). A. B. Parsons, Editor. 817 pages. 1947. American Institute of Mining and Metallurgical Engineers, 29 W. 39th St., New York, N. Y. $6.00.

Part I is composed of historical papers wherein experts in the fields of mining and metallurgy have reviewed: significant developments in mining geology (L. C. Graton); metal mining (Lucie-Eaton); ore dressing (A. F. Taggart); smelting and leaching of ores (F. Leist); iron and steel (C. D. King); nonferrous metallurgy (W. M. Pierce); bituminous-coal mining (H. N. Eaverson); anthracite industry (C. Evans and others); petroleum (E. L. DeGolyer); nonmetallics (Oliver Bowles); and mineral-industry education (T. T. Read). Part II contains the proceedings of the World Conference on Mineral Resources. Particularly significant are The Mineral Position of the United States, by J. A. Krug; Iron Ore and the Steel Industry, by Charles M. White; International Aspects of the Petroleum Industry, by William Fraser; The Future of Gold in World Economy, by P. M. Andersons; World Coal Resources, by C. Augustus Carlow; The Role of the Engineer in the Development of Atomic Energy, by P. C. Keith; Application of Atomic Energy to Industry, by H. A. Winne and B. R. Prentice; and Metals and Alloys, by Zay Jeffries, in a chapter by E. W. Pehrson, Mineral Economics Branch, U. S. Bureau of Mines, the entire 75-year statistical record is presented. (From review in *Science* v. 107, May 14, 1948.)

27b—Ferrous

27b-28. Practical Design of Simple Steel Structures. Vol. I. Edition 3. D. S. Steart. Constable and Company, Ltd., 10 Orange Street, London, W.C.2. 15s net.

Contents are very much as they were in previous editions, except that the structural tables, formerly published separately as Vol. III have been included in Vol. I. Shop practice and the design of riveted connections and beams. Assumes only a slight knowledge of the theory of structures and none at all of rolled-steel sections or of shop practice. Riveted connections are dealt with in some detail and separate chapters are devoted to simple riveted joints, flange-plate splices, splices for angles, joists and channels, splices for the web plates of plate girders, and eccentric riveted connections. Design calculations for each of the designs considered. A short chapter on wind pressure and factors of safety is followed by a long one on beam design, and a final chapter on the design of a joist-and-channel crane-gantry girder. (From review in *Engineering*, v. 165, March 19, 1948.)

27b-29. Werkstoff-Handbuch Stahl und Eisen. (Handbook of the Iron and Steel Industry.) 1944. Verlag Stahleisen, m.b.H., Dusseldorf-Possneck, Germany.

A series of brief monographs under five main headings: general; properties and tests; varieties of iron and steel classified according to manufacture and composition; varieties of iron and steel for specific purposes; and steel working and testing. (From review in *Journal of the Iron and Steel Institute*, v. 158, April 1948.)

27b-30. Modern Mechanical Saw Practice. J. R. Foyster, 274 pages. Crosby Lockwood & Son, Ltd., 20 Tudor Street, London, E.C. 4, England. 18s, net.

Latest information on mechanical wood-cutting saws and sawing technique. Chapters cover requirements of saw teeth, their action; comparison tests; use, protection, and adjustment of saws; saw maintenance; the forces operating in sawing such as centrifugal force and the influence of heat; and new methods of using saws. (From review in *Machinery* (London), v. 72, April 15, 1948.)

27b-31. Steel Files, Their Manufacture and Application. Eric N. Simons. Sir Isaac Pitman & Sons, Limited, Parker Street, Kingsway, London, W.C. 2, England. 15s. net.

Historical information, manufacturing, types and cuts of files, and use of files as well as "art of filing". (From review in *Foundry Trade Journal*, v. 84, April 15, 1948.)

27c—Nonferrous

27c-8. Pressure Die Casting. 62 pages. Birmingham Aluminum Casting Co., Ltd., Birmingham, England. 7s, 6d net.

After describing the various systems of pressure die casting—air blown, cold chamber and hot chamber—the handbook discusses the choice of alloys suitable for pressure die casting. Effects of factors such as permanence, surface finishes, effects of temperature, and mechanical strength and consistency. Technique of pressure die casting, giving details of the composition of alloys, mechanical properties, and tolerances and tapers, typical castings. Photographs of pressure die-casting shops. (From review in *Metal Industry*, v. 72, April 9, 1948,)

27c-9. Aluminum Bronze. Revised edition. 169 pages. 1947. Copper Development Association, Grand Building, Trafalgar Sq., London, W.C.2.

Consists of sections on general properties, including structure and transformations; alpha Al bronzes; Al bronzes for hot working; Al bronzes for casting; corrosion resistance; production; fabrication; applications; and Al bronzes for service at elevated temperatures.

27c-10. Copper and Copper Alloys. Owen W. Ellis. 184 pages. 1948. American Society for Metals, 7301 Euclid Ave., Cleveland, Ohio. $3.50.

Five lectures presented at 29th annual National Metal Congress and Exposition Oct. 18-24, 1947. Historical development; metallurgy; melting; complex alloys of Cu and Zn; and other alloys of Cu. 109 ref.

27d—Light Metals

27d-5. Alcoa Aluminum and Its Alloys. 154 pages. 1947. Aluminum Company of America, Pittsburgh.

Chemical and physical properties, heat treatment, products, castings, fabricating practices, and tables of data.

27d-6. Aluminum and Its Applications. Hiram Brown and Others. 338 pages. 1948. Pitman Publishing Corporation, 2 W. 45th St., New York. $5.75.

Applications are demonstrated in standing authorities in the fields of individual chapters written by outaircraft assemblies, aircraft engines, aircraft castings, automotive manufacture, railroads, marine assemblies, electrical appliances and equipment, and the chemical industries. The major alloys and fabricating methods with each step. Leading manufacturers and fabricators are represented by contributions or discussions.

27d-7. Welding and Brazing Alcoa Aluminum. 128 pages. 1947. Aluminum Company of America, Pittsburgh, Pa. A manual.

27d-8. Aluminum and Its Alloys. Edition 2. N. F. Budgen. 369 pages. 1947. Pitman Publishing Corp., 2 W. 45th St., New York City, N. Y.

Various branches of metallurgical work related to and comprising the aluminum industry. Properties, processes and methods employed in their manufacture and their applications in modern engineering.

27d-9. Technologie der Leichtmetalle. (The Technology of Light Metals.) A. von Zeerleder. 364 pages. Rascher Verlag, Zurich, Switzerland. 45s net.

Book deals only very briefly with the history and the methods of production of aluminum and magnesium. Practical rather than theoretical issues predominate in the discussion of commercial light alloys. Properties and mechanical testing; corrosion resistance and analysis; design; impact extrusion; drawing; production of hollow parts by spinning, beating, and deep drawing; heat treatment; machining; soldering and welding; riveting; surface treatment; choice of light alloys; applications; and storage. (From review in *Metal Industry*, v. 72, April 9, 1948.)

ADVERTISERS INDEX

American Chemical Paint Co. ... 55
Armour Ammonia Works ... 35
Columbia Electric Mfg. Co. ... 43
Detrex Corp. ... 39
Electric Furnace Co. ... 51
Enthone, Inc. ... 37
Harshaw Chemical Co., ... Front Cover, 31
Holden Co., A. F. ... Back Cover
Institute of Metals ... 49
Laboratory Equipment Corp. ... 43
Mac Dermid, Inc. ... 45
Ryerson & Son, Inc., Jos. T. ... 29
Waverly Petroleum Products Co. 49

~ ~ ~

A. P. Ford, Advertising Manager
7301 Euclid Ave., Cleveland 3, Ohio
UTah 1-0200

Robt. S. Muller, Eastern Manager
55 West 42nd St., New York 18
Chickering 4-2713

Don Harway, West Coast Rep.
1709 West 8th St., Los Angeles 14
FAirfax 8576
68 Post St., San Francisco 4
Yukon 6-1069

Mail This Hotel Reservation Form Now!

For the 30th

NATIONAL METAL CONGRESS & EXPOSITION

PHILADELPHIA COMMERCIAL MUSEUM and CONVENTION HALLS

Metal Exposition Opens Monday, October 25 to Friday, October 29

(Certain Technical Sessions Will Be Held Saturday and Sunday, October 23 and 24.)

Extensive plans are being completed to provide interest during your visit to the 30th National Metal Congress and Exposition. You won't want to miss this outstanding technical program and metal show. In view of the large number planning to attend, we urge you to order double rather than single rooms and plan joint reservations so as to occupy all double rooms and twin-bedded rooms to capacity.

Cooperating Societies and Hotel Headquarters

American Society for Metals—Benjamin Franklin . . . American Welding Society—Bellevue-Stratford . . . Institute of Metals Division, American Institute of Mining and Metallurgical Engineers—Adelphia . . . Society for Non-Destructive Testing—Benjamin Franklin.

HOTEL RATES IN PHILADELPHIA

Hotel	Single	Double	Twin-Bedded
ADELPHIA	$5.00 up	$7.00 up	$8.00 up
BARCLAY	5.00 up	8.00 up	8.00 up
BELLEVUE-STRATFORD	4.00 up	7.00 up	8.00 up
BENJAMIN FRANKLIN	4.50 up	6.50 up	8.00 up
BRIERHURST	2.50 up	3.50 up	5.00 up
BROADWOOD	3.00 up	5.00 up	6.00 up
CHANCELLOR HALL	4.00 up	6.00 up	6.00 up
CHATEAU CRILLON			7.00 up
DRAKE	5.00 up	7.00 up	8.00 up
ESSEX	3.50 up	5.50 up	7.00 up
HAMILTON COURT	3.00 up	6.00 up	6.00 up
LORRAINE	3.50 up	6.00 up	x8.00 up
MAJESTIC	2.50 up	5.00 up	x6.00 up
NORMANDIE	3.50 up	4.50 up	5.00 up
PARKER	3.50 up	4.50 up	5.50 up
PENN-SHERATON	4.00 up	6.00 up	6.50 up
RITZ-CARLTON	5.50 up	8.00 up	8.00 up
ROBERT MORRIS	3.00 up	5.00 up	6.00 up
ST. JAMES	3.50 up	5.50 up	7.50 up
SHERATON	5.00 up		7.50 up
SYLVANIA	4.00 up	6.00 up	6.00 up
TRACY	x3.50 up	4.50 up	4.50 up
WALNUT PARK PLAZA	4.00 up	6.50 up	7.50 up
WARBURTON	3.50 up	5.50 up	6.00 up
WARWICK			8.00 up
WHITTIER	3.00 up	5.00 up	6.00 up
WALT WHITMAN	5.00 up	7.00 up	8.00 up

x—Without Bath.

FILL OUT AND MAIL THIS COUPON — NOW!

Charles L. Todd, Manager, Housing Bureau
Architects Bldg., 17th and Sansome Streets
Philadelphia 3, Pa.

Date.....

Please make hotel reservations as shown below:

Hotel..... 1st Choice

Hotel.....2nd Choice

Hotel..... 3rd Choice

(If hotel of 1st choice is unable to accept reservation, Housing Bureau will endeavor to comply with your 2nd or 3rd choice.)

Number of Rooms with Bath.....Double Bed Room(s) — Rate Preferred $.....

.....Twin-Bedded Room(s) — Rate Preferred $.....

.....Single Room(s) — Rate Preferred $.....

Arrival Date October..... ☐ A.M. ☐ P.M. Departure Date October.....

Note: If you find that you are to arrive after 6 P.M. or on a different day than reservations called for, be sure to wire hotel before the date of your reservation, informing them accordingly. Otherwise your reservations may be cancelled.

Room(s) Will Be Occupied by: (Be sure to designate those who are to occupy same room.)

NAME STREET CITY STATE

.....

.....

Applicant.....Title.....

Company.....

Street Address.....

City.....Zone.....State.....

Member of A.S.M. ☐ A.W.S. ☐ A.I.M.E. ☐ S.N.D.T. ☐

IMPORTANT: Assignment of rooms will be made by the Housing Bureau beginning **August 1st, 1948,** BUT NOT EARLIER. As soon as possible thereafter you will receive confirmation direct from the Housing Bureau. Duplicate will go to the hotel accepting reservations.

HOLDEN Sal
AND FURN
for Scale Free HEA
FOR 300°F TO 2350°F.

- ☐ **LIQUID CARBURIZING**
  100% Water-Soluble
- ☐ **NEUTRAL HARDENING**
- ☐ **NITRIDING**
  High Speed Steels
  Nitralloy Steels
  Stainless Steels
  Chrome Molybdenum Steels
- ☐ **TEMPERING**
- ☐ **BRIGHT TEMPERING**
- ☐ **HOT QUENCHING**
- ☐ **BLACKING**
- ☐ **DESCALING**
  Simultaneous Annealing and Descaling
- ☐ **ISOTHERMAL HEAT TREA**
  Martempering
  Austempering
  Isothermal Annealing
- ☐ **ANNEALING**
  Non-Ferrous Metals
- ☐ **BRAZING**
  Silver Brazing
  Brass Brazing
  Copper Brazing
- ☐ **FORGING**
  Free from scale
- ☐ **QUENCHING OILS**
  180° F. to 200° F.
  200° F. to 400° F.
- ☐ **CLEANING RUBBER MOLDS**
- ☐ **CARBON COVERS**
  1000° F. to 2000° F.
  Save 35% fuel consumption
- ☐ **RECTIFIERS FOR NEUTRAL HARDENING**

FURNACES AND EQUIPMENT

- ☐ **POT FURNACES**
  Gas, Oil, Electric
  Gas Fired (No Blower Required)
  Gas or Oil Fired (Pressure Fired)
  Electric Resistance
  Electric Electrode Furnaces (Steel or Ceramic Pots)
  Electric Calrod Furnaces
  Marquenching or Austempering
- ☐ **PREFABRICATED CONVEYOR UNITS for**
  Liquid Carburizing
  Neutral Hardening
  Austempering
  Martempering
  Isothermal Heat Treating
  Isothermal Annealing direct from Forging Press
  Aluminum Heat Treating
  Annealing and Descaling
- ☐ **HOT WATER WASH TANKS**
- ☐ **QUENCHING TANKS**
- ☐ **CONVEYOR QUENCH TANKS**
- ☐ **ALLOY POTS**
- ☐ **PRESSED STEEL POTS**
- ☐ **CERAMIC POTS**
- ☐ **WELDED STEEL POTS**
- ☐ **WELDED ALLOY POTS**
- ☐ **ALLOY POT RINGS**
- ☐ **THERMOCOUPLES**
- ☐ **ALLOY LADLES**
- ☐ **ALLOY BASKETS AND FIXTURES**
- ☐ **OIL COOLERS**
- ☐ **ALLOY ELECTRODES**
- ☐ **HOODS**
- ☐ **PYROMETERS**
- ☐ **TIMERS**

CHECK AND MAIL FOR PRODUCT INFORMATION

NATION-WIDE SERVICE
Call Nearest HOLDEN *Office for Prompt Metallurgical Advice*
HOME OFFICE AND FACTORY
New Haven, Connecticut 9-5090

ALABAMA
New Orleans, La. Office..*Raymond 2185*
ARKANSAS
New Orleans, La. Office..*Raymond 2185*
CALIFORNIA
Los Angeles Office .....*Prospect 6411*
CONNECTICUT
New Haven Office *9-5090*
New Haven Distributor *2-5558*
DELAWARE
Plainfield, New Jersey Office *6-9289*
Philadelphia, Pa. Distributor—*Market 7-6121 or Park 4000*
DISTRICT OF COLUMBIA
Washington Office .....*Republic 7268*
FLORIDA
New Orleans, La. Office ..*Raymond 2185*
GEORGIA
Atlanta Office .....*Main 4451*
ILLINOIS
Chicago Office .....*Canal 6811 or 1950*
Chicago Distributor .....*Harrison 2040*
St. Louis, Mo. Distributor ..*Lucas 7400*
INDIANA
Chicago Office—*Canal 6811 or 1950*
Fort Wayne Distributor *E-1394*
IOWA
Chicago Office—*Canal 6811 or 1950*
Chicago, Illinois Distributor..*Harrison 2040*
KANSAS
Tulsa, Oklahoma Office *3-8878*
KENTUCKY
Columbus, Ohio Office ....*Randolph 3768*
LOUISIANA
New Orleans Office .....*Raymond 2185*
MAINE
Boston Office—*New Haven, Conn. 9-5090*
MARYLAND
Washington, D. C. Office ....*Republic 7268*
MASSACHUSETTS
Boston Office ..*New Haven, Conn. 9-5090*
New Haven, Conn. Distributor (Western Mass.) *2-5558*
MICHIGAN
Detroit Office .....*Randolph 3540*
MINNESOTA
Minneapolis Office .....*Atlantic 6281*
MISSISSIPPI
New Orleans, La. Office ..*Raymond 2185*
MISSOURI
St. Louis Distributor .....*Lucas 7400*
NEBRASKA
Omaha Office .....*Atlantic 7050*
NEW HAMPSHIRE
Boston Office—*New Haven, Conn. 9-5090*
NEW JERSEY
Plainfield, New Jersey Office ..*6-9289*
Metropolitan New York Office (Newark area) .....*Academy 2-7292*
Philadelphia Distr.—*Market 6121 or Park 4000*
NEW YORK
New York Office (Metropolitan, N. Y.)—*Academy 2-7292*
Skaneateles Office (Upper N. Y.)— *7451*
OHIO
Cleveland Office .....*Boulevard 2876*
Cleveland Distributor (N. E. Area)—*Main 8864*
Detroit Office (Toledo Area)—*Randolph 3540*
OKLAHOMA
Tulsa Office *3-8878*
OREGON
Portland Office .....*Atwater 1466*
PENNSYLVANIA
Cleveland, Ohio (Western Pennsylvania Area) .....*Boulevard 2876*
Plainfield, N. J. Office (Eastern Pennsylvania Area) *6-9289*
Erie Distributor *32-964*
Pittsburgh Distributor .....*Court 6114*
RHODE ISLAND
Boston Office—*New Haven, Conn 9-5090*
TEXAS
Dallas Office .....*Riverside 3855*
Houston Office .....*Preston 3231*
VERMONT
New Haven, Conn. *9-5090*
VIRGINIA
Richmond Office *2-5814*
WEST VIRGINIA
Cleveland Office (East. Area)—*Boulevard 2876*
Columbus, Ohio (West. Area)—*Randolph 3768*
WASHINGTON
Seattle Office .....*Lander 7100*
WISCONSIN
Chicago Office—*Canal 1950 or 6811*

THE A. F. HOLDEN COMPANY • *Metallurgical Engineers*

Manufacturers Heat Treating Baths and Furnaces • NEW HAVEN 8, CONN.

FOREIGN MANUFACTURERS • Canada: Peacock Brothers, Ltd., Montreal • France: Fours Electriques Ripoche, Paris • Belgium: Le Four Industriel Belge, Antwerp and other principal countries